AD-A013 533

A GENERALIZED AIR QUALITY ASSESSMENT MODEL FOR AIR FORCE OPERATIONS--AN OPERATOR'S GUIDE

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Argonne National Laboratory

Prepared for:

Air Force Weapons Laboratory

July 1974

DISTRIBUTED BY:

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AFWL-TR-74-54

AFWL-TR-
74-54

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Argonne National Laboratory
Argonne, IL 60439

July 1974 (Rev. May 1975)

Final Report for Period 1 May - 1 January 1974

Approved for public release; distribution unlimited.

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland AFB, NM 87117

This final report was prepared by Argonne National Laboratory, Argonne, Illinois, under Project Order 74-015, Job Order 19008W03. Captain Dennis F. Naugle (DEE) was the Laboratory Project Officer-in-Charge.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFWL-TR-74-54	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER AD-A013 533
4. TITLE (and Subtitle) A GENERALIZED AIR QUALITY ASSESSMENT MODEL FOR AIR FORCE OPERATIONS--AN OPERATOR'S GUIDE		5. TYPE OF REPORT & PERIOD COVERED Final Report 1 May 1973 to 1 January 1974
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Lawrence E. Wangen and Donald M. Rote		8. CONTRACT OR GRANT NUMBER(s) Project Order 74-015
9. PERFORMING ORGANIZATION NAME AND ADDRESS Argonne National Laboratory 9700 South Cass Avenue Argonne, IL 60439		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Program Element 62601F Project 1900
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Weapons Laboratory (DEE) Kirtland Air Force Base, NM 87117		12. REPORT DATE June 1974
		13. NUMBER OF PAGES [illegible]
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Supersedes AD-784 809

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Environics
Civil engineering
Air pollution
Dispersion model

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Energy and Environmental Division of Argonne National Laboratory has developed a set of computer programs under contract to the United States Air Force Weapons Laboratory. This package is designed to serve as a generalized model that can be used to assess the impact of Air Force operations on the air environment at the air base level. This report is a user's manual for these computer programs and as such outlines the overall flow of the programs, the links between programs and the input data required to implement (over)

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) each program. This document is intended to provide detailed instructions as to input flow and not to supply technical or scientific basis. A companion document subtitled, "Phase 1 Technical Report" discussed the modeling theory and methods.

PREFACE

This document constitutes fulfillment of the requirement for an interim user's manual. Major portions of this computer code were developed by Dorothy J. Bingham, Mary A. Snider, Phyllis L. Walker, and Stanley D. Zellner at Argonne National Laboratory.

This report is one of five closely related published or planned Air Force Weapons Laboratory Technical Reports. AFWL-TR-73-199 presents aircraft pollution emission data to be used as emission factors (indicies) for environmental assessments. This report, AFWL-TR-74-54, describes how to code input data in a usable format for the AQAM. Both a technical report, discussing modeling theory and methods used, and a computer documentation manual, discussing the mechanisms of the computer code, will also be published as a result of the current contract with Argonne National Laboratory. The final related technical report is being planned to include detailed procedures and methods by which base-level personnel can collect the required raw data to perform a complete air quality analysis on an Air Force base.

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SECTION I

INTRODUCTION

This manual is intended to be used by personnel who wish to carry out an assessment of the air quality impact of air base operations using the interim version of the Argonne Air Base Air Quality Model.

The manual contains detailed instructions on the use of the model and a user-oriented description of the model itself and how it works. A more technical description of the model theory is discussed in a companion report.

I.1 PURPOSE OF THE MODEL

The purpose of the model is to compute concentrations of various pollutant species over a grid of receptors resulting from emissions of air pollutants from aircraft, air base, and surrounding environ sources. At the user's option these computations can be made on either a short-term (hour-by-hour) or long-term (using a climatological/dispersion model) basis for the purposes of:

- Assessment of air quality impact of air base operations.
- Evaluation of effect of modifications of air base design or operations on the air quality.
- Determination of relative importance of aircraft, air base, environ emission sources.
- Comparison of computed air quality with monitored air quality.

I.2 PROGRAM STRUCTURE

The overall structure of the computer version of the Air Quality Model is illustrated in Figure 1. The model consists of four independent computer programs:

- Source Inventory Program
- Meteorological Data Program
- Long-Term Emission/Dispersion Program
- Short-Term Emission/Dispersion Program

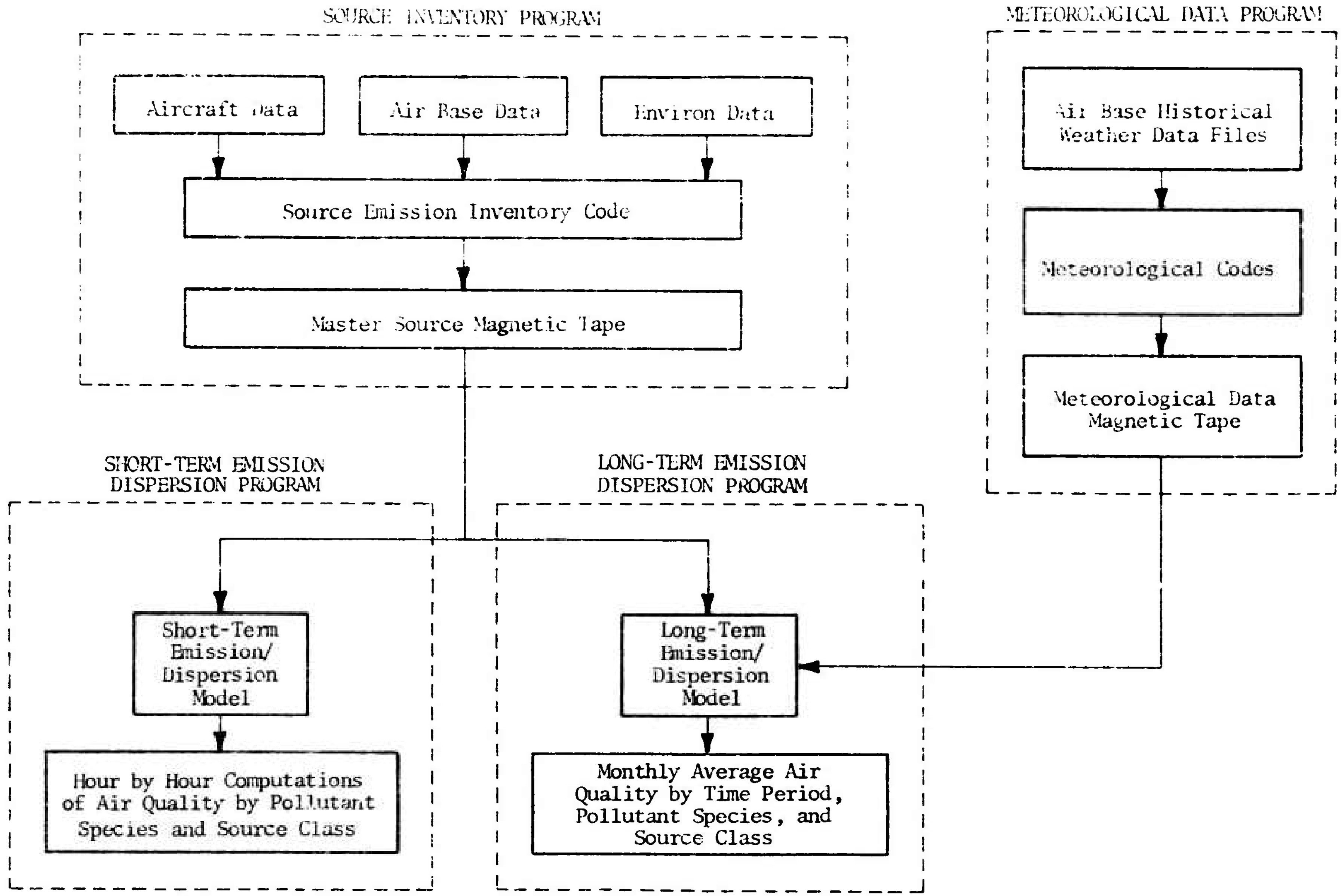


Figure 1. Overall structure of A Generalized Air Quality Assessments Model for Air Force Operations

Each of these programs requires its own input data as described in Sections II, III and IV.

The Source Inventory Program requires user-prepared input data and operation by the user. Its primary function is to produce a magnetic tape containing source data and annual emission rates. In addition to the magnetic tape, which is used as input to both the Long and Short-Term Time Period Emission/Dispersion Programs, the Source Inventory Program also provides a print-out of the annual emissions for each source in the inventory.

The Meteorological Data Program is operated by USAF Environmental Technical Applications Center (ETAC) at the request of the user for a particular air base. This program requires as input historical records of meteorological data collected at the air base of interest or at a nearby weather station. It produces a magnetic tape containing all the meteorological data required for the Long-Term Time Period Emission/Dispersion Program.

The Long and Short-Term Time Period Emission/Dispersion Programs are operated by the user and require, in addition to the source magnetic tape (prepared by the user), other input data which depends upon several user options which define the type of computations to be done, such as:

- Whether Long Term or Short Term
- If Long Term, Which Time Period
- Etc.

If the user chooses a long-term calculation, he must order the meteorological data tape for the air base of interest from ETAC. He must then choose which of the several possible time periods (portions of a day) he wishes to carry out monthly average air quality computations. If the user desires a short-term calculation, which computes air quality on an hour-by-hour basis, he will have to prepare a computer card deck containing hourly meteorological data which either corresponds to some historical period of interest (such as during a time when air quality monitoring data is available) or which represents some type of hypothetical sequence of meteorological events. Regardless of options, the ultimate purpose of these programs is to compute the emission for the desired time periods and determine the air quality concentrations in micrograms/cubic meter at each receptor for each pollutant of interest. The user can perform as many short-term (hourly) or long-term (monthly) computations in sequence as computer time constraints will allow.

1.3 OPERATING INSTRUCTIONS - OVERVIEW

At this point a brief description of how the air quality models are used is given. Details regarding individual computer code operations and input specifications are given in subsequent sections.

To use the air quality models, the user must carry out the following steps:

a) If the user plans to carry out long-term calculations (monthly average values of air quality concentration) he should order a meteorological data tape from ETAC (see specifications in Section II).

b) If the user plans to carry out short-term calculations (hour-by-hour concentrations) he must prepare a computer card deck containing hourly average values of the meteorological variables (see specifications in Section IV).

c) Regardless of whether a long or a short-term calculation, the user must prepare a complete source emission inventory according to the precise specifications given in Section III. This inventory is required input to the Source Emission Inventory Code which must be run to write the Master Source Magnetic Tape. Once this master tape has been prepared, it can be used repeatedly for a wide variety of computations.

d) The user must specify the type of computation and the number of computations he wishes to perform in sequence. This specification requires the selection of one option from each of several sets of options. For the short-term model he must specify calendar data including the month, the number of consecutive hours within a given period of interest, and whether the period corresponds to a weekday or weekend. A particular period of consecutive hours can have any length up to 100 hours. The computations of the emissions for the hours within a given period also require the choice of several options. For the long-term model, the user must choose which of seven time periods (0-2400, 0600-0900, etc.) he wishes to use for his computations of monthly average air quality. Each of the seven time periods is defined to be compatible with the meteorological data records stored on the Meteorological Data Tape.

e) Having prepared all of the input and decided upon the appropriate combination of user options, the user can now run the appropriate Time Period Emission/Dispersion Program and compute the air quality. In the interim version of the air quality model, the output is limited to tabular results for each receptor of interest. The user can select up to 300 receptors on a uniform rectangular grid and up to 12 additional receptors with arbitrary positive coordinate values.

SECTION II

METEOROLOGICAL DATA PROGRAM

This computer program is operated by ETAC* at the request of the user. It processes a historical weather data file and creates the meteorological data tape used for the Long-Term Time Period Emission/Dispersion Program.

II.I STRUCTURE OF THE METEOROLOGICAL DATA TAPE

The meteorological data is supplied on an 800 bits per inch, binary coded decimal, card image tape unless other arrangements are made with ETAC. The following is a description of the data tape, its format, and a general background on some of the parameters that went into the tape.

Table 1 is a listing of the first few card images on a meteorological data tape prepared for Wright-Patterson AFB.

The first card image is an initial identification which gives the WBAN (Weather Bureau/Army/Navy) station locator number and the number of stability classes on the tape.

The second card image is a header record which identifies the meteorological data which follows and gives some average meteorological conditions for the time period. It contains the following data punched in the specified columns:

---

*United States Air Force, Environmental Technical Applications Ctr, Building 159, Navy Yard Annex, Washington DC 20333

Table 1

FORMAT OF METEOROLOGICAL DATA TAPE

```
1 STATION PROCESSED IS   13860     5 STABILITY CLASSES
000101002-  30.2  17.9   1077.9    988.5    681.7         4.4      39.0
```

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	N A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	NNE A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	NE A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	ENE A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	E A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	ESE A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	SE A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	SSE A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	S A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	SSW A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	SW A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	WSW A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	W A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	WNW A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	NW A JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	NNW A JAN
0.	0.	0.	0.	0.	0.	N A JAN
0.	0.	0.	0.	0.	0.	NNE A JAN
0.	0.	0.	0.	0.	0.	NE A JAN
0.	0.	0.	0.	0.	0.	ENE A JAN
0.	0.	0.	0.	0.	0.	E A JAN
0.	0.	0.	0.	0.	0.	ESE A JAN
0.	0.	0.	0.	0.	0.	SE A JAN
0.	0.	0.	0.	0.	0.	SSE A JAN
0.	0.	0.	0.	0.	0.	S A JAN
0.	0.	0.	0.	0.	0.	SSW A JAN
0.	0.	0.	0.	0.	0.	SW A JAN
0.	0.	0.	0.	0.	0.	WSW A JAN
0.	0.	0.	0.	0.	0.	W A JAN
0.	0.	0.	0.	0.	0.	WNW A JAN
0.	0.	0.	0.	0.	0.	NW A JAN
0.	0.	0.	0.	0.	0.	NNW A JAN
0.001293	0.000000	0.000000	0.000000	0.000000	0.000000	N B JAN
0.000259	0.000000	0.000000	0.000000	0.000000	0.000000	NNE B JAN
0.000517	0.000000	0.000000	0.000000	0.000000	0.000000	NE B JAN
0.000517	0.000000	0.000000	0.000000	0.000000	0.000000	ENE B JAN
0.000259	0.000000	0.000000	0.000000	0.000000	0.000000	E B JAN
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	ESE B JAN
0.000776	0.000000	0.000000	0.000000	0.000000	0.000000	SE B JAN
0.001293	0.000000	0.000000	0.000000	0.000000	0.000000	SSE B JAN
0.001034	0.000000	0.000000	0.000000	0.000000	0.000000	S B JAN
0.002027	0.000000	0.000000	0.000000	0.000000	0.000000	SSW B JAN
0.001034	0.000000	0.000000	0.000000	0.000000	0.000000	SW B JAN
0.000776	0.000000	0.000000	0.000000	0.000000	0.000000	WSW B JAN
0.001551	0.000000	0.000000	0.000000	0.000000	0.000000	W B JAN
0.000517	0.000000	0.000000	0.000000	0.000000	0.000000	WNW B JAN
0.001034	0.000000	0.000000	0.000000	0.000000	0.000000	NW B JAN
0.000776	0.000000	0.000000	0.000000	0.000000	0.000000	NNW B JAN
454.	0.	0.	0.	0.	0.	N B JAN
421.	0.	0.	0.	0.	0.	NNE B JAN
585.	0.	0.	0.	0.	0.	NE B JAN
441.	0.	0.	0.	0.	0.	ENE B JAN
449.	0.	0.	0.	0.	0.	E B JAN
0.	0.	0.	0.	0.	0.	ESE B JAN
443.	0.	0.	0.	0.	0.	SE B JAN
450.	0.	0.	0.	0.	0.	SSE B JAN
413.	0.	0.	0.	0.	0.	S B JAN
415.	0.	0.	0.	0.	0.	SSW B JAN
434.	0.	0.	0.	0.	0.	SW B JAN
477.	0.	0.	0.	0.	0.	WSW B JAN

(1) Section number - Format I4, Columns 1-4 (see Table 2)

(2) Month-1-Jan, 2-Feb, etc., 13-Annual, Format I2, Columns 5-6

(3) Start time (LST) - Format I2, Columns 7-8

(4) Stop time (LST) - Format I2, Columns 9-10

(5) Mean Temperature (°F) - Format F6.1, Columns 11-16

(6) Mean temperature range (°F) - F6.1, Columns 17-22

(7) Mean heating degree days - (Base 65°) Format F10.1, Columns 23-32

(8) Mean station pressure (mb) - Format F10.1, Columns 33-42

(9) Mean pressure altitude (feet) - Format F10.1, Columns 43-52

(10) Mean surface wind speed (m/sec) - Format F10.1, Columns 53-62

(11) Percent of time the prime runway is potentially active - Format F10.1, Columns 63-72

The next 16 card images are the wind stability data for the time period (in this case, January 00-24 hrs) and stability category A. The wind stability data is a joint frequency distribution of surface wind direction, wind speed, and Pasquill Stability category for the time interval.

(1) The Pasquill stability categories were determined using the method outline by Turner in the J. Appl. Meteorol., Vol 3, Feb 64, pp. 83-91.

(2) The wind speed classes are: 0-3 knots, 4-7, 8-12, 13-18, 19-24, and greater than 24 knots. Calms are distributed equally with respect to wind direction and included in the 0-3 knot category.

(3) Wind direction is divided into the standard 16 compass points starting with North.

The card image format is (6F10.6, 2X, A10). The 6 categories are

Table 2

METEOROLOGICAL DATA TAPE

SECTION NUMBERS AND THEIR CORRESPONDING TIME PERIODS

MONTH	TIME INTERVAL (Local Standard Time)						
	00-24	06-18	06-09	09-15	15-18	18-21	21-06
JAN	1	14	27	40	53	66	79
FEB	2	15	28	41	54	67	80
MAR	3	16	29	42	55	68	81
APR	4	17	30	43	56	69	82
MAY	5	18	31	44	57	70	83
JUN	6	19	32	45	58	71	84
JUL	7	20	33	46	59	72	85
AUG	8	21	34	47	60	73	86
SEP	9	22	35	48	61	74	87
OCT	10	23	36	49	62	75	88
NOV	11	24	37	50	63	76	89
DEC	12	25	38	51	64	77	90
ANN	13	26	39	52	65	78	91

sequential wind speed classes; 0-3 knots in columns 1-10, 4 7 in columns 11-20, 8-12 in columns 21-30, 13-18 in columns 31-40, 19-24 in columns 41-50, and greater than 24 knots in columns 51-60.

The 16 rows are the sequential wind direction categories starting with North. The "A10" alpha-numeric field in card columns 63-72 gives the wind direction, stability category, and month of the card image so data can be checked by hand. In this case, stability category A does not occur at Wright Patterson in January, so the wind stability frequency distribution is 0.

The next 16 card images give the average mixing depth for each of the 16 corresponding wind stability categories. Note that when the wind stability category is 0, the mixing depth is not computed and a 0 is entered. The mixing depth card image format is (6F10.0,2X, A10). This data was developed following the procedure given in ETAC Report 1053, "Mixing Depth Model Using Hourly Surface Observations" by Capt Ken Nozaki, Nov 73. The following 16 card images are the wind stability data for the time period and stability category B.

This is followed by the corresponding mixing depth data.

The tape continues in this format through stability category F, which completes the data for the time period. Section 2 (see Table 2) then starts, giving the header record, the wind stability, and mixing depth information for February, 00-24 hours. This continues through the 91 sections, which completes the meteorological data tape.

II.2 GENERAL INSTRUCTION

To obtain the meteorological data tape, the user must submit to FTAC a request that data from the air base of interest or a nearby weather station be processed by the Meteorological Data Program.

SECTION III

SOURCE INVENTORY PROGRAM

III.1 INTRODUCTION AND OVERVIEW

The primary aim of the source inventory program is to create a master data set on magnetic tape containing all the information needed to define source geometries and annual emissions. Certain other types of data, such as temporal activity distributions, aircraft arrival-departure path descriptions and dispersion parameters are also defined and/or input. In addition, all input is output for diagnostic and other purposes and the annual emission of each pollutant is output according to various source types, as well as a cumulative total.

There are three general categories of sources which are treated separately by the program. These are:

1) Aircraft sources; which consist of all arriving, departing and training flights, as well as the associated taxiing, idling, and direct servicing of these aircraft.
2) Air base non-aircraft sources; which include all those air base emission sources not directly due to aircraft flight activity.
3) Environ sources; which include all ground-based emission sources outside the physical boundaries of the air base.

A given source will have one of three possible geometries depending on its actual spatial configuration. These are point, area and line geometries. The generalized types of information needed to specify an emission source are:

- Location of the emission source in space.
- Initial dimensions of the plume.
- Mass emission rate of each pollutant.

The specific input data required to accomplish these three tasks will vary depending on the particular source category and geometry.

We have striven for both generality and specificity in the handling of source emissions. Thus, where possible, the user is required to provide only source activity data, and emission rates are calculated by the use of appropriate emission factors. For example, in the case of aircraft sources, the essential data necessary to calculate emission rates is annual aircraft activity in the form of arrivals, departures and tough-go operations. In other instances the user may be required to input actual emission rates for a given source, e.g., the environ point sources. Thus although the model is intended primarily for air bases, it is general enough to handle any other facility providing the user specifies the geometry and emissions.

Some core restrictions are listed in Table 2.a. The structure of the program is given in Figure 2 and a description of user inputs is given in Section III.10.

III.2 BLOCK DATA

The block data is used only to initialize variables resident in labeled or named common blocks. Many variables are given default values here which, in general, the user would not change. Where non-default values of these parameters are desired, they are input at the proper time. In addition, the emission factors used by stationary sources are defined in this routine.

III.3 AIRCRAFT EMISSION FACTORS

Emission factors, as a function of aircraft type, are calculated in ACEFCT utilizing engine pollutant emission factors and fuel flow rates. These aircraft emission factors are in units or kg/hr/engine for each of nine different operating modes for each aircraft type. The eleven modes are defined in Table 3. All operational modes are assumed to be a linear combination of four engine thrust categories defined as idle, normal, military, and afterburner. For a particular engine, these thrust categories imply a specific fuel flow rate and a specific set of emission factors. To change these aircraft emission factors would require only minor changes to ACEFCT for that particular operational mode. However, the user is not expected to alter this set of basic input data under normal circumstances.

III.4 SUBROUTINE INPUT

This routine is used for the addition of new aircraft and engines not previously defined or anticipated by the model. It is also used to read in most of the basic aircraft data needed in the calculation of arrival-departure paths (Figure 3) and associated pollutant emissions along those paths when the default values defined in BLOCK DATA are not to be used. The temporal distribution arrays for aircraft, automobiles and fuel handling activity are also entered here if non-default values are desired. These data types are entered by NAMELIST read statements (see Tables 3a, 4, 5).

Table 2a

Core Limitations on Various User Oriented Input Data

Variable	Variable Name	Data Set	Maximum Number	Comment
Aircraft	NACTYP	5.A	8	
Park Area	NPKAR	5.A	6	
-subsquares	NPASA	5.C	3	max. of 3 per parking area
Pollutants	NPLTS	--	6	Data statement
Runways	NRNWYS	5.A	6	
Special Cases	NSCASE	5.A	3	
Taxiway Segments	NLSEGS	5.A	25	
Sources, Aircraft				
Point	NACPT		1	Currently are none
Area	NACAR		24	NPKAR·NPASA + NRNWYS
Line	NACLN		250	Upper Limit: 9·NACTYP·NRNWYS + NLSEGS
Sources, Airbase				
Point	NABPT	6.A-6.F	150	Sum of NTFS,NTCS,NRNS,NPPS, NICS and NSTS
Area	NMAX	7.A	100	
HC Work	NWRK	7.B	100	7.B through 7.F emissions
HC Breath	NMAXE	7.C	100	are all placed into area
HC Park	NMAXE	7.D	100	sources defined by 7.A
HC Park	NMAXE	7.E	100	
HC Other	NXEVP	7.F	100	
Space Heating	NSHS	7.G		sum of these must be
Off Road Veh	NORVHS	7.H		less than or equal to
Military Veh	NMVHAR	7.I		250
Civilian Veh	NCVHAR	7.J		
Line	NMAX	8.A	200	
Military Veh	NMVHLN	8.B		sum of these must be
Civilian Veh	NCVHLN	8.C		less than or equal to
Other	NXLN	8.D		250
Sources, Environ				
Point	NMAX	9.A	100	
Area	NMAX or NMAX1 + NMAX2	9.B	100	
Line	NMAX1 + NMAX2	9.C	20	

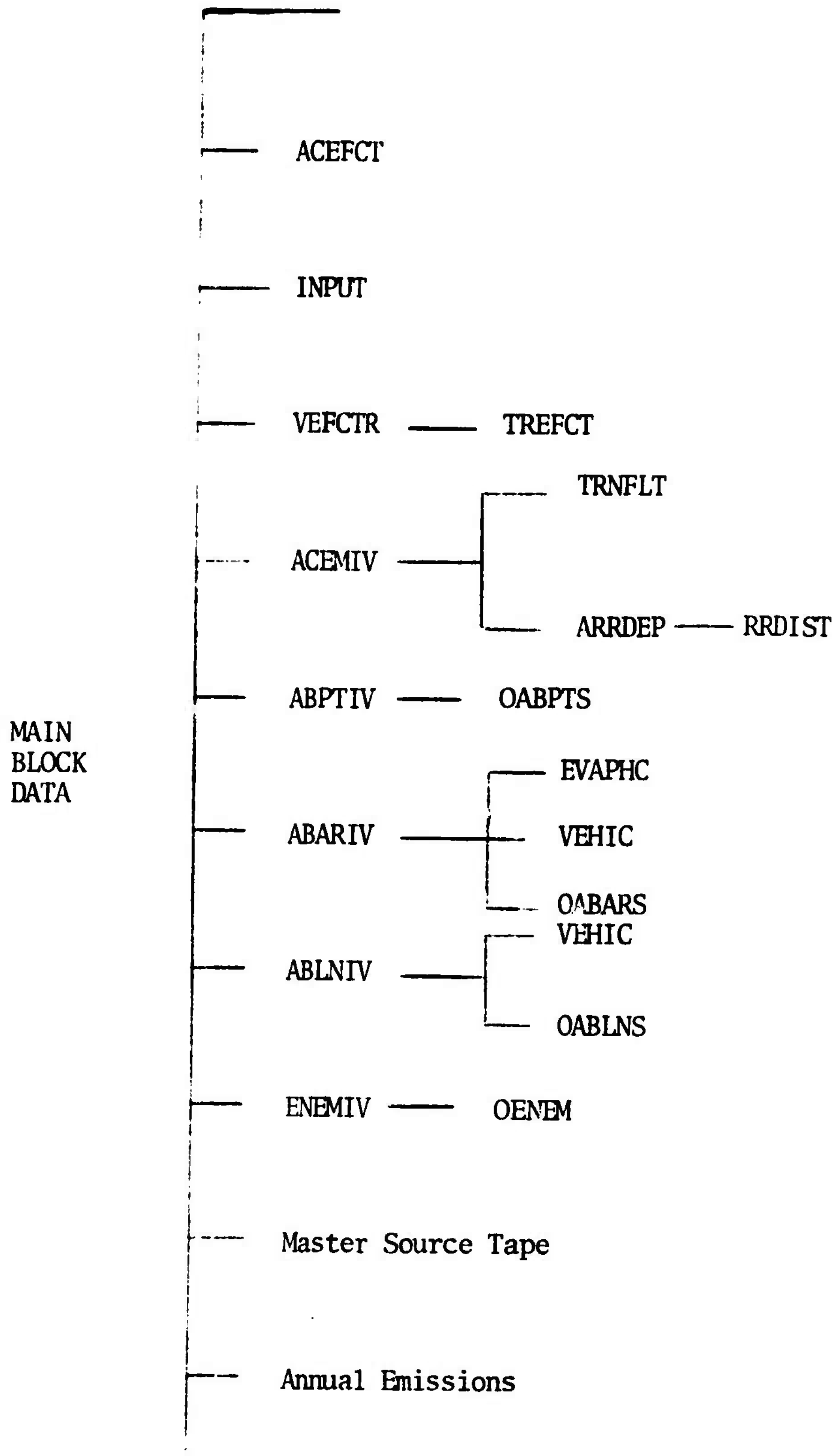


Figure 2. Structure of source inventory model.

Table 3

Operational Modes in the Arrival-Departure Path

(See Figure 3)

Operational Mode	Mode ID Number	Engine Thrust Setting
Idle at Start Up	1	Idle
Outbound Taxi	2	Idle
Engine Check	3	Military
Runway Roll	4	Afterburner*
Climbout 1	5a	Afterburner
Climbout 2	5b	Military
Approach 1	6a	Normal
Approach 2	6b	0.4 Idle, 0.6 Normal
Landing on Runway	7	Idle
Inbound Taxi	8	Idle
Idle at Shutdown	9	Idle

*When an aircraft engine does not have or does not use an afterburner, substitute military.

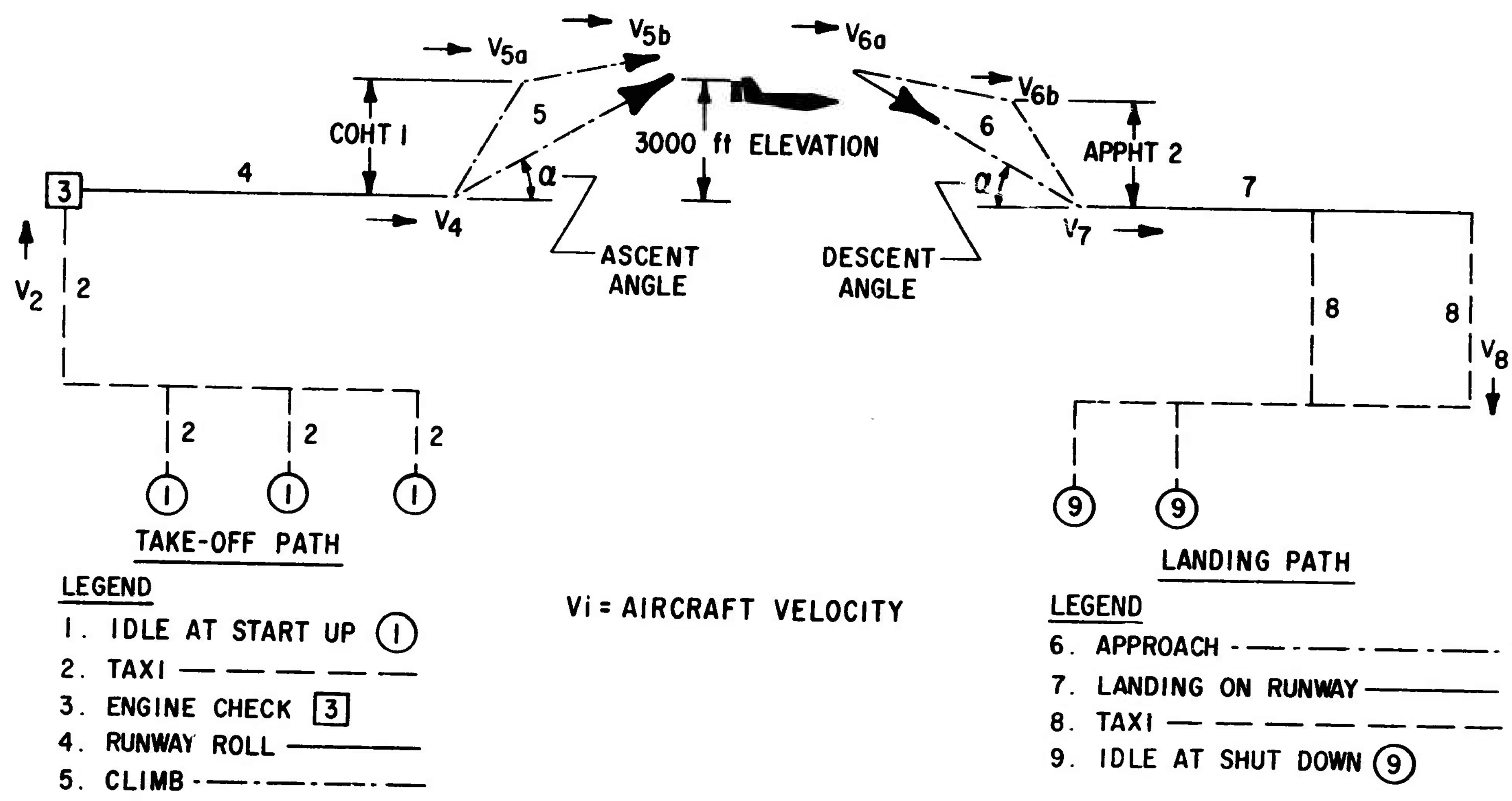


Figure 3. LANDING AND TAKE-OFF PATHS, 1 AND 9 REFER TO THE AIRCRAFT PARKING AREA

Table 3a

Definition* of Variables Contained in Namelist/EGDATA/

Variable	
ACNAME(50)	Aircraft type
EGNAME(25)	Engine type
EGEMFC(6,4,25)**	Pollutant emission factors according engine type
EGFF(4,25)**	Engine fuel flow rates
IACABF(50)	Aircraft afterburner-use flag $\begin{pmatrix} 1 = \text{yes} \\ 0 = \text{no} \end{pmatrix}$
IDACEG(50)	Engine used by aircraft
IEGABF(25)	Engine afterburner flag $\begin{pmatrix} 1 = \text{yes} \\ 0 = \text{no} \end{pmatrix}$
IDRR(50)	Runway roll equation used by aircraft

*A dimension of 50 refers to aircraft type dependence and a dimension of 25 refers to engine type.

**Six pollutants and 4 engine thrust settings.

Table 4

Definition* of Variables in NAMELIST/ACDATA/

Variable	Units	Meaning
APPHT	kilometers	Altitude at start of approach (3000 feet)
CLMBHT	kilometers	Altitude at end of climbout (3000 feet)
ENGNO(50,1)		Number of engines
ENGNO(50,2)		Number of engines divided by 2, rounded up ($\geq$ 1)
DSCNT1(50)	degrees	Angle for first phase of approach
DSCNT2(50)	degrees	Angle at final approach
APSPD1(50)	km/hr	Speed at beginning of approach
APSPD2(50)	km/hr	Speed at beginning of 2nd phase of approach
APPHT2(50)	kilometers	Altitude at beginning of 2nd phase of approach
ASCNT1(50)	degrees	Angle of ascent after take-off
ASCNT2(50)	degrees	Angle of ascent after shut-off of after-burner
COSPD1(50)	km/hr	Speed at end of initial phase of climbout (usually at afterburner shutoff)
COSPD2(50)	km/hr	Speed at end of climbout to CLMBHT
COHT1(50)	kilometers	Altitude at afterburner shutoff
TXISPD(50)	km/hr	Taxi speed
LNDSPD(50)	km/hr	Landing speed (at point of touchdown)
TOSPD(50)	km/hr	Lift-off speed
SRTUPT(50)	min/engine	Idle at start-up time
EGCHKT(50)	min/engine	Engine check time
SHTDNT(50)	min/engine	Idle at shut-down time
TOWT(50)	thousand pound	Take-off weight

*A dimension of 50 implies that the variable is a function of aircraft type.

See Figure 3 for further descriptions of some of these parameters.

Table 5

Definition of the Variables Contained in NAMELIST/DSDATA/

Variable	Dimension	Default	Meaning
ACMO(J,I)	12,50	1/12	Monthly distribution of aircraft activity for aircraft type I
ACDY(J,I)	2,50	1/7	Weekday or weekend day value for aircraft activity for aircraft I
ACHR(J,I)	24,50	1/12 or 0	Hourly distribution of aircraft activity for aircraft I

The following are analogous to the aircraft activity arrays with identical defaults but only a dimension analogous to J.

VHMLMO, VHMLDY, VHMLHR	Military Vehicle Activity Distributions
CVABMO, CVABDY, CVABHR	Civilian Vehicle Activity Distributions on Airbase
CVENMO, CVENDY, CVENHR	Civilian Environ Vehicle Activity Distriutions

The following are also analogous except for a dimension which refers to type of fuel being processed:

FLMO(12,4), FLDY(2,4), FLHR(24,4)

These fuel processing activity arrays are currently used for the temporal distribution of evaporative hydrocarbons; the fuel types and corresponding identifying numbers are given in Table 19.

III.5 AUTOMOTIVE EMISSION FACTORS

Automobile emission factors for the six vehicle classes of Table 6 are calculated in VEFCTR and TREFCT. These codes generate one set of emission factors for the hot running mode, another set assuming the 1975 Federal Environmental Protection Agency urban driving cycle, as well as cold start emission factors and hydrocarbon losses due to carburetor soak and other sources. A complete description of these factors is given in Reference 1.

III.6 EVAPORATIVE HYDROCARBON LOSSES

Subroutine EVAPHC calculates hydrocarbon losses due to the handling and storage of the large amounts of fuel used for aircraft and ground vehicle operations at an air base. These emissions result from the evaporation, spilling and venting of fuels. The hydrocarbon emissions resulting from fuel evaporation depend on many variables including fuel vapor pressure, ambient temperature, wind speed and various tank parameters such as tank diameter and capacity. Empirical relations[2] developed by the American Petroleum Institute for fuel loss due to the storage and handling of liquid petroleum fuels are used in the model.

III.7 AIRCRAFT SOURCE INVENTORY

The actual source inventory data begins with the input to subroutine ACEMIV for the identification of aircraft sources. These include all of the activities listed in Table 3, in addition to fuel venting, vehicles providing direct service to arriving and departing aircraft, and refueling of aircraft. Input data is primarily keyed to aircraft and runway. The runway(s) being used at any particular time is a function of wind direction and speed, as well as aircraft type. Thus, information specifying this dependence must be provided. The form of this data will be made clear in the input description.

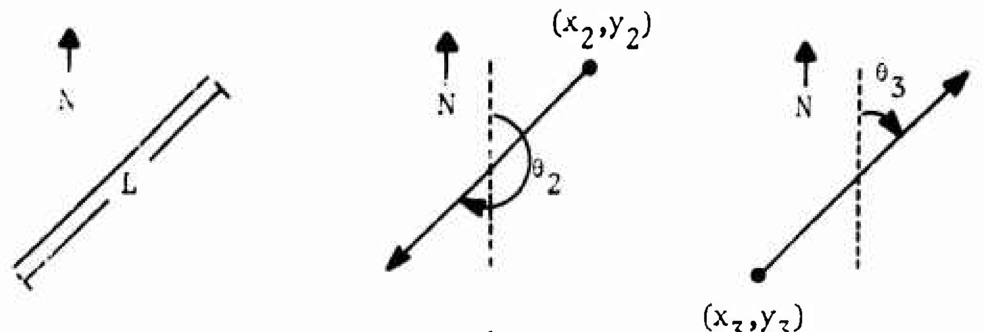
As certain conventions are assumed concerning runways, it is necessary that these be clearly understood. A runway is considered to be a vector quantity; that is, it has both a length and a direction. Thus, if aircraft land and takeoff on a physical strip of pavement in both directions, this strip of pavement constitutes two runways, both of the same length, but of opposite direction. As an example, the physical strip of pavement of length "L" pictured below in "a" would be considered as two runways depending on

Table 6

Vehicle Class Definitions

Class	Definition - Gross Vehicle Weights in Pounds
1	Cars
2	Light duty trucks (GVW $\leq$ 6000)
3	Trucks 6000 < GVW < 16000
4	Trucks 16000 < GVW < 33000
5	Trucks GVW > 33000
6	Diesel trucks and buses

the direction in which arriving and departing aircraft are using it, as pictured in "b" and "c." The arrows are drawn in the direction in which the aircraft are traveling. Runway b is specified by L, θ_2, x_2, y_2, while Runway c is specified by L, θ_3, x_3, y_3. Where θ is the angle measured clockwise from time N (north), x and y are the coordinates of the runway (arrow) tail. The x and y are the coordinates of the point where runway roll starts for departing aircraft (also the engine check point), which are the same as the touchdown coordinates for arriving or inbound aircraft. (Actually the model assumes that inbound craft touch down 1000 feet up the runway from this point.)



Thus, in specifying Runway b, the expected input is θ_2, x_2 and y_2, as well as the number of arrivals, departures and touch-go flights that occur on this runway vector. Similarly the inputs for Runway c are θ_3, x_3, 1/3 and the associated activity occurring on this runway vector.

The actual user input that must be provided will be itemized in Section III.10.

III.8 AIR BASE SOURCE INVENTORY

The air base sources consist of all non-aircraft sources on the air base. These include the categories such as Power Plants and Automobiles, in addition to special sources such as Test Cells and Training Fires.

Air Base Point Sources considered are listed in Table 7. Annual emissions are calculated internally by user-provided activity measurements except for "other," where annual pollutant emissions must be provided. Large Storage Tank Point Sources could contain more than one tank, e.g., three or four tanks of the same capacity located at one area. These storage tanks could be classed as area sources as well, since they have no plume rise.

Table 7

Air Base Non-Aircraft Emission Sources

Point	Line	Area
Training Fires	Military Vehicle	Fuel, Working
Test Cells	Civilian Vehicle	Fuel, Spillage
Runup Stands	Other	Fuel Breathing
Power Plants		– Storage Tanks
Incinerators		– Tank Trucks
Large Storage Tanks		– Auto Parking
Other		Other Hydrocarbons
		Space Heating
		Off-Road Vehicles
		Military Vehicle
		Civilian Vehicle

Air Base Line Source emissions are divided into the categories shown in Table 7, column two. However, the emissions from these categories may originate from the same line. Thus, the geometries of all air base non-aircraft sources to be treated as lines are first set up, after which the various activity is allocated to the appropriate spatial location (line). This is done to provide data gathering flexibility in the treatment of military versus civilian vehicle activity. For this reason it is imperative that the proper identification source number be provided for each activity.

Line source category "other" would include any air base line sources not covered by the previously listed two categories in Table 7, such as locomotives.

All air base non-aircraft sources which, for reasons of geometry and/or emission strength, do not conveniently fit into point or line sources are placed into area source geometries. Area source input is treated in much the same way as that for air base line sources; that is, first, geometries and identification numbers are assigned to each base area which gives rise to significant emissions, then the various activities, as listed in column 3 of Table 7, are input and assigned to a given area.

Hydrocarbon working losses are assumed to be a function only of total throughput, i.e., total amount of fuel processed in a given area, and therefore, the annual throughput for each of 4 types of fuel is input for each pertinent area source. At the same time, an annual spill estimate is input. In contrast, hydrocarbon breathing losses are more dependent on tank parameters. Thus, breathing losses are handled by consideration of petroleum storage tanks and vehicle parking areas. The category of other hydrocarbons is intended to refer to hydrocarbon sources such as degreasing racks, paint spray booths, dry cleaning establishments, etc.

Space heating uses emission factors from the same list (Table 8) as used for point source power plants. Off-road vehicles are military diesel vehicles which operate primarily off the main roads. Military and civilian vehicles are activities analogous to those for air base lines except here one is dealing with networks of roadways or minor roads not active enough to be treated as line sources.

Table 8

Power Plant Emission Factor Identification Numbers and Activity Units

	Furnace Type - Size*	Emission Factor Identification Number	Activity Unit
Bituminous Coal	Greater 100 (Utility - Large Industrial)	1	Metric Tons
	10 to 100 (Large Commercial - General Industrial)	2	
	Less 10 (Commercial and Domestic)		
	Spreader Stoker	3	
	Hand-Fired	4	
Anthracite Coal	Pulverized (Dry Bottom), No Fly-Ash Reinjection	5	Metric Tons
	Greater 10, Overfeed Stokers, No Fly-Ash Reinjection	6	
	Less 10, Overfeed Stokers, No Fly-Ash Reinjection	7	
	Hand-Fired	8	
Fuel Oil	Greater 100 (Power Plant)	9	Cubic Meters (Liquid)
	10 to 100 (Industrial and Commercial)		
	Residual (both Horiz. and Tangen. Fired)	10	
	Distillate (both Horiz. and Tangen. Fired)	11	
	Less 10 (Domestic)	12	
Natural Gas	Greater 100 (Power Plant)	13	10^6 Cubic Meters (Gas)
	Industrial Process	14	
	Commercial	15	
	Domestic	16	
LPG +	Industrial Process - Butane	17	Cubic Meters (Liquid)
	Industrial Process - Propane	18	
	Commercial Boilers - Butane	19	
	Domestic Boilers - Butane	20	
	Commercial Boilers - Propane	21	
	Domestic Boilers - Propane	22	

*Numbers refer to furnace size rated in units of million BTU heat input.

+For LPG S or sulfur is input as grains of sulfur per 10,000 cubic meters of gas vapor rather than per 100 cubic meters as stated in the Emission factor handbook.

III.9 ENVIRON SOURCE INVENTORY

The environs are defined as all sources located outside the physical boundaries of the air base. Environ source data is input according to the three distinct source geometries of point, area, and line. Automobile emission factors are the only emission factors provided, because the large number of possible sources in the environs makes it impractical to code all the emission factors.

POINT SOURCES located in the environs require the explicit input of all the point source data as shown in Tables 9 and 10. No default values for initial dispersion parameters or stack parameters are allowed. In addition, the actual annual emission rate in metric tons per year (a metric ton is 1000 kilograms) must be provided.

AREA SOURCES in the environs may be treated by one of three options according to user preference, although, if possible, it is recommended that option number one or three be used. The required geometric data for area sources are listed in Table 11. The emission or activity data to be input depends on the option chosen.

Option one provides for the input of mobile source data (in the form of vehicle mileage, route speed and cold starts) and stationary source data which is presumed to consist mainly of commercial and residential space heating. The vehicle emissions are distributed in time by distribution functions for civilian environ vehicles specified by the user in subroutine INPUT. The annual space heating emissions are distributed in time by the degree-hour method and require no user input other than meteorological data.

Option two utilizes land-use based emission factors[3] and, therefore, requires the input of fractional land use by each of the land-use categories as defined by Table 12. This method is to be used only when good data are not available.

Option three lumps all activities together and allows the user to use whatever method is most appropriate or desirable to generate the annual emissions for each environ area source.

Environ LINE SOURCES are specified as either roadway or non-roadway lines. The required geometric data for each are identical in form (Table 13);

Table 9

Source Emission Data Required Where Actual Annual Emissions are Input

Emissions Data (10^3 kgm/year)	Meaning
1. ID	4-Digit Source ID number
2. CO	Annual Carbon Monoxide Emission in metric tons
3. HC	Annual Hydrocarbon Emission in metric tons
4. NOX	Annual Nitrogen Oxides Emission in metric tons
5. PART	Annual Particulate Emission in metric tons
6. SOX	Annual Sulfur Exides Emission in metric tons
7. POL6	etc.
8. POL7	.
9. POL8	.
10. POL9	.

Format (I4,4X,9F8.2)

Table 10

Point Source Physical Data

	Parameter	Units	Meaning
1.	ID		4-Digit Source ID number
2.	PLMD*		Plume Rise Formula Flag
3.	X†	(km)	Ground Level Coordinates of Source
4.	Y†	(km)	Center
5.	H0	(M)	Stack Height
6.	ΔY	(M)	Initial Horizontal Dispersion Parameter
7.	ΔZ	(M)	Initial Vertical Dispersion Parameter
8.	TS**	(^{o}K)	Stack Exit Gas Temperature
9.	VS	(M/S)	Stack Exit Gas Velocity
10.	DS	(M)	Stack Diameter
11.	HB	(M)	Building Height

Format (2I4,9F8.2)

*Plume Rise Formula Flags
0 ⇒ no plume rise, 1 ⇒ Holland, 2 ⇒ Carson-Moses, 3 ⇒ Carson-Moses for training Fires (Heating Rate is input rather than stack gas parameters)

†X refers to the east/west axis and Y to the north/south axis with the signs defined in the conventional way

**For training fires, substitute Q which is the heating rate in kilocalories per second.

Table 11

Area Source Geometric Data

	Parameter	Units	Meaning
1.	ID		4-Digit Source ID number
2.	PLMD*		Plume rise formula flag
3.	X	(km)	Ground level coordinates of center of area source
4.	Y	(km)	
5.	$\bar{z}$	(M)	Average emission height
6.	L	(M)	Length of side of square
7.	ΔZ	(M)	Initial vertical dispersion parameter

Format (2I4,5F8.2)

*Leave Blank

Table 12

Land-Use Categories
According to Northern Research Classification
and Corresponding Identification Sequence Number

Land-Use Category	Land-Use Identification Number
City Center	1
Urban Area	2
Suburban Area	3
Semi-Rural	4
Rural	5
Cemetery	6
Park	7
Airport	8

Table 13

Line Source Geometric Data

	Parameter	Units	Meaning
1.	ID		4-Digit Source ID number
2.	PLMD*		Plume rise formula flag
3.	X_1	(km)	Ground level coordinates of one end of line
4.	Y_1	(km)	
5.	Z_1	(m)	Average emission height at (X_1, Y_1)
6.	W	(m)	Width of line (ΔY)
7.	ΔZ	(m)	Initial vertical dispersion parameter
8.	X_2	(km)	Ground level coordinates at opposite end of line
9.	Y_2	(km)	
10.	Z_2	(m)	Average emission height at (X_2, Y_2)

Format (2I4,8F8.2)

*Leave Blank

however, the activity data to be input are not. For roadways, vehicle mileage and speed are input by vehicle class as per Table 14, while for non-roadways, the actual emissions in annual metric tons are required.

III.10 SOURCE INVENTORY INPUT DATA

Input data to the program consists of user-provided NAMELIST data and conventional user-provided formatted card input. The input data sets are listed in Table 15.

The first three sets of input data are the three NAMELIST entries from subroutine INPUT. These are:

Data Set 1	NAMELIST/EGDATA/
Data Set 1a	NAMELIST/ACDATA/
Data Set 2	NAMELIST/DSDATA/

and are used to add to or make any changes in the basic engine or aircraft data (Tables 3a, 4) or to change the temporal distribution arrays (Table 5) to non-default values. It is expected that some of the basic aircraft data will vary among different air bases and that new engine and aircraft types may be added. It should also be noted that for anything but daily average calculations, the default uniform emission distribution would be invalid unless the source activities are indeed uniform over time. In any event, if no changes are desired, it is necessary to input the following three NAMELIST cards (for a CDC 6600 machine):

	Column									
	1	2	3	4	5	6	7	8	9	10
Card 1	b*	$	E	G	D	A	T	A	b	$
Card 2	b	$	A	C	D	A	T	A	b	$
Card 3	b	$	D	S	D	A	T	A	b	$

The user should consult a Fortran manual for the rules regarding NAMELIST read statements for a particular machine. The order of entries on the input card is immaterial, and individual elements of an array may be input or entire arrays. As an example, suppose it is desired to redefine the first and second phase climbout angles (ASCNT1 and ASCNT2) for the aircraft used at the base and that these aircraft and new climbout angles in degrees are F5 with ID #13 and new angles 15.0, T37 with ID #31 and new angles 7.5, and T38 with ID #32 and new angles 8.0. The input cards are as follows (on page 40):

*a 'b' on an input card signifies a blank in that column.

Table 14

Basic Vehicle Input Data

Vehicle Data (2I4 7F8.2)		Card 1
1. ID		Must agree with ID on source data card
2. CLDST	= 1	Hot running emission factors used (gm/mi)
	= 2	Cold running emission factors used (gm/mi)
	= 3	Combine hot running emissions (gm/mi) with cold start emissions (gm/cold start)
3. SPEED (mi/hr)		Average route speed
4. VM_i (10^3 mi/year)		10^3 vehicle miles per year for each of 6 vehicle classes: i = 1,6

If CLDST = 3, cards 2 and 3 must be input

Cold Start Data (7I4)	Card 2
1. ID	Must agree with ID on preceding card
2. $CDSTN_i$ (10^3 starts/year)	Thousands of cold starts per year for each of 6 vehicle classes: i = 1,6

Hot Soak Data (2I4)	Card 3
1. ID	Must agree with ID on preceding card
2. NHSOAK	Thousands of hot soaks per year

Table 15

Source Inventory Input Data Sets

Data Set Number	Data Description
1	NAMELIST/EGDATA/
1a	NAMELIST/ACDATA/
2	NAMELIST/DSDATA/
3	Annual Meteorological Data
4	Car and Truck Emission Data Parameters
5*	Aircraft Emission Inventory
5.A	Number of Aircraft Types, et al.
5.B	Aircraft Identification and Activity
5.C.1	Aircraft Parking Areas
5.C.2	Taxiway Segment Data
5.D*	Runway Specific Information
5.D.1	Runway Geometry
5.D.2	Runway - Wind Direction Use
5.D.3	Runway - Aircraft Use
5.D.4	Runway - Taxiway Number
5.D.5.1	Runway - Inbound Taxiway Use
5.D.5.2	Runway - Inbound Taxiway Segments
5.D.6.1	Runway - Outbound Taxiway Use
5.D.6.2	Runway - Outbound Taxiway Segments
5.E	Arrival Service Vehicle Emissions
5.F	Departure Service Vehicle Emissions
5.G	Refueling of Aircraft
5.H	Spillage During Refueling Operations
5.I.1&2	Fuel Venting Emissions
6*	Air Base Source Inventory

*Numbers so designated require no actual input from user.

Table 15 (Cont'd)

Source Inventory Input Data Sets

Data Set Number	
6.A	Training Fires
6.B	Test Cells
6.C	Runup Stands
6.D	Air Base Power Plants
6.E	Air Base Incinerators
6.F	Air Base Storage Tanks
6.G	Other Air Base Point Sources
7*	Air Base Area Sources
7.A	Air Base Area Source Geometries
7.B	Hydrocarbon Working Loss
7.C	Hydrocarbon Breathing Losses - Storage Tanks
7.D	Tank Truck Hydrocarbon Breathing Losses
7.E	Military and Civilian Vehicle Hydrocarbon Breathing Losses
7.F	Other Evaporative Hydrocarbon Sources
7.G	Space Heating Sources
7.H	Off-Road Vehicle Sources
7.I	Military Vehicle Area Sources
7.J	Civilian Vehicle Area Sources
8*	Air Base Line Sources (Non-Aircraft)
8.A	Air Base Line Source Geometries
8.B	Air Base Military Vehicle Line Activity
8.C	Air Base Civilian Vehicle Line Activity
8.D	Other Air Base Line Activity
9*	Environ Source Data
9.A	Environ Point Sources
9.B	Environ Area Sources
9.C	Environ Line Sources

*Numbers so designated require no actual input from user.

Column	1 2 3 4 5 6 7 8 9 10 11 12 . . . etc.
Card 1	b $ A C D A T A b A S C N T 1 (1 3
	) = 1 5 . 0 , A S C N T 2 (1 3) = 1
	5 . 0 ,
Card 2	b A S C N T 1 (3 1) = 7 . 5 ,
	A S C N T 2 (3 1) = 7 . 5 , A S C N
	T 1 (3 2) = 8 . 0 , A S C N T 2 (3
	2) = 8 . 0 $

Note that if more than one card is necessary, the first column on all cards must be a blank. All cards must have complete elements of an array and end in a comma.

Data set 3 is the first user-provided formatted input and consists of one card containing the meteorological parameters defined by the following list:

	Variable	Columns	Definition
	TBAR	1-8	Average annual temperature (°F)
	ADD	9-16	Annual degree days
Format (5F8.2)	PA	17-24	Pressure altitude (hundred feet)
	WSBAR	25-32	Annual average wind speed (m/sec)
	DTBAR	33-40	Daily average temperature variation (°F)

Data set 4 provides the information needed by VEFCTR and TREFCT to calculate automobile and truck emission factor. The required variables are listed below. There is one card specifying the basic options to be used in the computation of the emission factors with the parameters listed below:

	Variable	Columns	Meaning
	IAREA	1-4	= 1 Low altitude
			= 2 High altitude
			= 3 California
Format (6I4)	IHDVML	5-8	= 1 No gross vehicle weight dependence for heavy duty gasoline-powered military vehicles emission factor calculation
			= 2 Heavy duty gasoline-powered military vehicle emission factors are dependent on gross vehicle weight
	IHDVCV	9-12	Same as IHDVML but for civilian vehicles
	IAATML	13-16	= 0 Military vehicle age distribution to be input by user
			= 1 National vehicle age distribution to be used for military vehicles, no input

Variable	Columns	Meaning
IAATCV	17-20	Analogous to IAATML for civilian vehicles
IYEAR	21-24	Current year or year of emission inventory

If IAATCV = 0, the civilian vehicle age distribution for each of six vehicle classes for vehicles up to 15 years old must be provided,* 1 card for each vehicle class, each card containing the fraction of total vehicles of that class that are 0, 1, 2 ... 15 years old. Each of these distributions must sum to 1.0. The format is (I2, 2X, I2, 2X, 16F4.4), decimal point is not punched, vehicle class must be placed in column 2 while a one or zero is punched in column 6 to indicate if that vehicle class does or does not use the default age distribution.

If IAATML = 0, information analogous to that for civilian cars and trucks must be provided for military cars and trucks.

Thus, there is a possibility of either 1, 7 or 13 cards being provided by the user for data set 4.

Data set 5 consists of all data input to the aircraft emission inventory routine (ACEMIV) and is divided into subsets which are described below in order of input.

DATA SET 5.A

	Variable	Columns	Definition
	NACTYP	1-4	Number aircraft types (max. = 8)
Card 1	NRNWYS	5-8	Number runways used (max. = 6)
Format (5I4)	NPKAR	9-12	Number aircraft parking areas (max. = 6)
	NSCASE+	13-16	Number of special runway-use cases (max. = 3)
	NLSEGS	19-20	Total number of taxiway segments (max. = 25)

*This requirement is optional by vehicle class, i.e., a 1 punched in column 6 of the age-distribution input card corresponding to the vehicle class specified in column 2 will force use of the default option for that class only.

+The special cases allow specification of runway use for up to three special combinations of wind speed and direction. For example, at one air base it is known that when the wind component along the vector at 135° is greater than 10 knots, a certain set of runways is used. These wind conditions do not depend only on wind direction and, thus, can be modeled according to one of the 16 defined wind directions. Thus, a special runway-use entry is provided for this carefully defined special case and entered as an element in the IUSWD array.

DATA SET 5.B -- Repeated NACTYP times (refer to aircraft data sheet 5.B)*

Format (I8,3F8.0)

Variable	Columns	Definition
IACTYP	1-8	Aircraft ID number (Table 16)
ANNARR	9-16	Annual arrivals of IACTYP
ANNDEP	17-24	Annual departures of IACTYP
ANNTGO	25-32	Annual touch-gos for IACTYP

DATA SET 5.C -- Repeated NPKAR times (refer to aircraft data sheet 5.C) Format (2I4,8F8.3)

Variable	Columns	Definition
IDPRKA	1-4	Parking area ID number
NPASA	5-8	Number of parking area squares making up parking area**
PAREA (ID,1,1)	9-16	X coordinate, (km) at center of square 1
PAREA (ID,1,2)	17-24	Y coordinate, (km) at center of square 1
PAREA (ID,1,3)	25-32	Length of side (km) of square 1
PAREA (ID,2,1)	33-40	X coordinate, center of square 2
PAREA (ID,2,2)	41-48	Y coordinate, center of square 2
PAREA (ID,2,3)	49-56	Length of side of square 2
⋮	⋮	⋮
PAREA (ID,J,1)		X coordinate, center of square J
PAREA (ID,J,2)		Y coordinate, center of square J
PAREA (ID,J,3)		Length of side of square J
⋮		⋮
		To J = NPASA

Repeat data set 5.C for each of the NPKAR parking areas.

*Data sheets referenced throughout this section are not supplied in this report but can be reproduced by using standard computer coding sheets and the variable format listed.

**If number of parking area squares is such that more than one card is required for each parking area, the parking area identification number and the number of parking area squares should be repeated in columns 1-4 and 5-8, respectively, on the new card.

	DATA SET 5.C.2	A loop over NLSEGS to set up the taxiway lane segments
	Variable	
	NC	Identification number of segment, must input in numerical order of 1, 2, 3 ... up to NLSEGS
Format (I4,4X,8F8.3)	ACLNSG(L,K)	Line source geometric data of Table 13, items 3-10 only, if left blank, the following defaults are provided: $Z_1 = Z_2 = 4.0$ m; $W = 20.0$ m; $\Delta Z = 8.0$ m

Repeat above card input for each of the NLSEGS taxiway lane segments.

Table 16

Computer Names and Identification Numbers for Aircraft

Aircraft	Computer Name	Identification Number
B-1	B1	1
B-52 C-E, F-G	B52 C-G	2
B-52 H	B52 H	3
B-57 A-3C	B57 A-3C	4
B-57 E-G	B57 E-G	5
F-100 A-F	F100	6
F-101 A-H	F101	7
F-102 A	F102	8
F-104 A-G	F104	9
F-105 B-G	F105	10
F-106 A-B	F106	11
F-4 A-D, E	F4	12
F-5 A-B	F5	13
F-111 A-F	F111	14
F-15	F15	15
A 7D	A7	16
A-10	A10	17
A-37A, B	A37	18
C-5A	C5	19
C-9A	C9	20
C-130 A-S	C130	21
KC-135A	C135 KC-135A	22
KC-135 B-U	KC135 B-U	23
C-141 A	C141	24
C-7	C7	25
C-47 A-Q	C47	26
C-97 D-L	C97	27
C-119 G/K	C119	28
T-29	T29	29

Table 16 (cont'd)

Computer Names and Identification Numbers for Aircraft

Aircraft	Computer Name	Identification Number
T-33 A-B	T33	30
T-37B	T37	31
T-38	T38	32
T-39 A-F	T39	33
T-41	T41	34
0-1A	01	35
0-2 A,B	02	36
0V-10A	0V10	37
Additional Aircraft		38 - 50

DATA SET 5.D -- Runway information, steps 1-7 must be repeated NRNWYS times, i.e., for each runway vector, where a runway vector is defined as in Section III.7.

1. Runway geometry data (refer to aircraft data sheet 5.D.1).

Format	Variable*	Columns	Definition
	IDRW	1-4	Runway ID number
	RNWY(2,N)	9-16	X coordinate of runway (km)
	RNWY(3,N)	17-24	Y coordinate of runway (km)
	RNWY(4,N)+	25-32	Z coordinate of aircraft jets (m) (default is 4m)
Format (I4,4X,7F8.3)	RNWY(5,N)+	33-40	Initial horizontal plume dispersion parameter (m) (default is 20m)
	RNWY(6,N)+	41-48	Initial vertical plume dispersion parameter (m) (default is 8m)
	RNWY(7,N)	49-56	Runway vector angle (deg)
	DISRNW(N)	57-64	Runway length (km)

2. Runway - wind direction use data (refer to aircraft data sheet 5.D.2)

Format	Variable	Columns	Definition
	IDRW	1-4	Runway ID number (must agree with above)
Format (I4,4X,20I1)	IUSWD(I,N)		Array of ones and zeros specifying whether or not runway N is used when the wind direction corresponds to I, where I = 1, (17 + NSCASE).

3.1 Aircraft arrival data for runway N by aircraft type (refer to aircraft data sheet 5.D.3.1).

Format	Variable	Columns	Definition
Format (I4,4X,8F8.0)	IDRW	1-4	Runway ID number must be same as above
	RNWYAR(I,N)	9-16 ⋮	Annual arrivals of aircraft I on runway N, where I is over NACTYP and must be input in same order as IACTYP (see data set 5.B)

3.2 Aircraft departures for runway N by aircraft type (refer to aircraft data sheet 5.D.3.2)

Format	Variable	Columns	Variable Definition
Format (I4,4X,8F8.0)	IDRW	1-4	Runway ID
	RNWYDP(I,N)	9-16 ⋮	Same as RNWYAR except for departures

*N refers to runway number N.

+Leave columns blank if wish to use defaults.

4. Taxiways (see aircraft data sheet 5.D.4).

	Variable	Columns	Description
	IDRW	1-4	Runway ID number (must agree with above)
Format (3I4)	NIBTT(N)	5-8	Number of inbound taxiway paths for runway N
	NOBTT(N)	9-12	Number of outbound taxiway paths for runway N

Taxiway paths are defined as the set of straight line segments connecting the runway at one end to the center of a parking area at the other. For a given runway vector, the outbound taxi paths from a given parking area will go to the opposite end of the runway as do the taxi paths for inbound aircraft. Therefore, because the model is keyed to inbound and outbound aircraft, it is necessary to define inbound and outbound taxiway paths.

5.1 and 5.2 are to be repeated for each inbound taxiway path.

5.1 Inbound taxiway use (see aircraft data sheet 5.D.5.1).

	Variable	Columns	Description
	IDRW	1-2	Runway ID (must agree with above)
	IDIBTW	3-4	Inbound taxiway path ID number
Format (3I2,2X, 8F8.3	IDPA	5-6	Identification number of the parking area where taxiway path terminates (must correspond to one of the parking areas input in data set 5.C)
	TTARFR* I=1, NACTYP	9-16 ⋮	A set of fractions, one for each aircraft type used at air base, specifying the fraction of aircraft type I arriving on runway IDRW that use taxiway path IDTW

5.2 Inbound taxiway path geometries (see aircraft data sheet 5.D.5.2).

Variable	Columns	Description
IDRW	1-2	
IDIBTW	3-4	Same as in 5.1
IDPA	5-6	
NSEGS	7-8 ⋮	Number of taxiway segments making up the taxiway path

*The order of input of these fractions must be the same as the order of input of IACTYP (data set 5.B). If 100 F 111's land on runway 7 per year and 15 of them use IDTW (or equivalently park at IDPA), the fraction would be 0.15 for F111's.

5.2 (continued)

	Variable	Description
Format (412,16I4)	IIBSEG(1) IIBSEG(2) . . . IIBSEG(NSEGS)	Identification numbers for each segment in the inbound taxiway path in sequential order from runway to center of parking area, just as an inbound aircraft would encounter them.

Note: Repeat 5.1 and 5.2 for each inbound taxiway path.

6.1 and 6.2 are to be repeated for each outbound taxiway path.

6.1 Outbound taxiway use (see aircraft data sheet 5.D.6.1) - analogous to 5.1, IDIBTW becomes IDOBTW, TTARFR becomes TTDPFR.

6.2 Outbound taxiway path geometries (see aircraft data sheet 5.D.6.2) - analogous to 5.2, IDIBTW becomes IDOBTW, IIBSEG becomes IOBSEG: taxiway segments are input in the same order as a departing aircraft would encounter them, starting with the segment originating at the center of the parking area identified by IDPA and ending with the segment terminating at the runway vector tail.

Note: Repeat 6.1 and 6.2 for each outbound taxiway path.

REPEAT DATA SET 5.D FOR EACH RUNWAY VECTOR

DATA SET 5.E* -- Service vehicle emissions due to arriving aircraft (refer to data sheet 5.E-F).

a is input for all NACTYP aircraft than

b is input for all NACTYP aircraft

Format (6F8.3)

a) Pollutant emissions in kilograms for NPLTS pollutants resulting from gasoline consuming vehicles servicing an incoming aircraft, one card per aircraft type.

b) Pollutant emissions in kilograms for NPLTS pollutants resulting from diesel consuming vehicles servicing one incoming aircraft, one card per aircraft type.

DATA SET 5.F* -- Service vehicle emissions due to departing aircraft (refer to data sheet 5.E-F).

Input the following for each aircraft type:

*Repeat a and b for each aircraft type at air base; loop over aircraft type is in same order as IACTYP input in data set 5.B.

Format (9F8.3)

a) Analogous to 5.E except for departing aircraft.

b) Analogous to 5.E except for departing aircraft.

DATA SET 5.G -- Average refueling in liter by aircraft type (see aircraft data sheet 5.G-I).

This is assumed to take place in the parking area, JP4 is assumed, Format is (I4, 4X, 3F8.3/(8X,8F8.3)). Read statement is READ 11, INPUTS, (ACFUEL(I), I = 1, INPUTS), where if you wish to input a different value for each aircraft, INPUTS = NACTYP followed by the refill value for each aircraft type in order (any one of which may be 0.0). If the same refill value is used for all aircraft, INPUTS = 1 and the one value follows. Set INPUT = 1 and the refueling value equal to 0.0 if no refilling occurs.

DATA SET 5.H -- Average spillage in liters of fuel during refueling operations (see aircraft data sheet 5.G-I).

Assumed to take place in parking area. Same rule for INPUTS and Format as given for data set 5.G.

DATA SET 5.I.1 -- Average fuel venting for arriving aircraft (see aircraft data sheet 5.G-I).

Average liters of fuel vented in parking area per aircraft arrival. Same rule for INPUTS and Format as given for data set 5.G.

DATA SET 5.I.2 -- Average fuel venting for departing aircraft (see aircraft data sheet 5.G-I).

Average liters of fuel vented per aircraft departure. Same rules as for INPUTS and format as given in data set 5.G.

END OF AIRCRAFT SOURCE EMISSION INPUT

Data set 6 begins the air base non-aircraft source inventory, briefly described in Section III.8, with the air base point sources. Point source data for the source types listed in column 1 of Table 7 are anticipated by the model.

Card 1 The first card is a flag punched in column 4 indicating the presence (> zero) or absence (zero) of air base point sources. If the flag is zero, go to Data Set 7; if greater than zero, go to Data Set 6.A.

1) Identification numbers for air base point sources start at 2001.

DATA SET 6.A -- Training fire sources (air base data sheet 6.A).

	Variable	Columns	
Card 1 (I4)	NTFS	1-4	Number of training fire sites

Card 2			Point source data for each site using basic format (Table 10) for items 1-7 and items
	8. Q		Heat emission rate (kilocalories/sec)
	9. ANFIRE		Annual number of fires
	10. GALPF		Gallons of JP4 consumed per fire

Default values provided if corresponding parameters are less than or equal to zero.

$Q = 2.54 \times 10^4$ kilocal/sec

$\Delta Z = 91.44$ m

$\Delta Y = 152.4$ m

$H_o = 0.0$ m

Repeat above card for all of the NTFS training fire sites.

DATA SET 6.B -- Test cell sites* (air base data sheets 6.B).

		Variable	Column	
Card 1	(I4)	NTCS	1-4	Number of test cell sites
Card 2				Point source data (Table 10) first site, except for item 2 which is:
		NENG		Number of engine types being tested at this site

Defaults provided when corresponding basic point source input data is less than or equal to zero.

$H_o = 10.0$ m

$\Delta Y = 10.0$ m

$\Delta Z = 10.0$ m

$T_s = 588.6^oK$

$V_s = 12.5$ m/sec

$D_s = 9.0$ m

$H_B = 10.0$ m

Card 3	(2I4,5F8.4)	ID	Must agree with ID on card 2
		IDENG	Engine type ID number (Table 17)
		TESTS	Number of annual tests of engine type IDENG at source site ID

*Engine classification is given in Table 17.

Table 17

Computer Names and Identification Numbers for Aircraft Engines

Engine	Computer Name	Engine ID Number
J-79	J 79	1
J-57	J 57	2
J-52	J 52	3
TF-33	TF33	4
TF-30	TF30	5
J-85	J 85	6
J-75	J 75	7
TF-39	TF39	8
T-56	T 56	9
T-76	T 76	10
0-470R	0470	11
IO-360	I360	12
Additional Engines		13 - 25

TIME(1) TIME(2) TIME(3) TIME(4)	Time in each of the four basic thrust settings in minutes per test (idle, normal, military and afterburner respectively)

1) Repeat card 3 for all of the NENG engine types.

2) Repeat card 2 and then NENG cards 3 for NTCS test cell sites.

DATA SET 6.C -- Run-up stand sites (air base data sheets 6.C).

		Variable	Columns	
Card 1	(I4)	NRNS	1-4	Number of run-up stand sites
Card 2				Point source data (Table 10) for each site, except for item 2 which is (in analogy to test cells)
		NENG		Number of engine types tested at this site

Defaults provided when corresponding basic point source parameters are less than or equal to 0.0.

H_o = 5.0 m

ΔY = 5.0 m

ΔZ = 5.0 m

T_s = 0.0

V_s = 0.0

D_s = 0.0

H_B = 5.0 m

Card 3 Identical to card 3 for test cell sites

1) Repeat card 3 for all of the NENG engine types.

2) Repeat card 2 and the NENG cards 3 for NRNS run-up stand sites.

DATA SET 6.D -- Air base power plants (air base data sheets 6.D).

		Variable	Columns	
Card 1	(I4)	NPPS	1-4	Number of power plants
Card 2				Point source data (Table 10) for each plant, no defaults allowed
Card 3	(2I4,3F8.2,I4)			
		ID	1-4	Must agree with ID on card 2
		MFCID	5-8	Power plant emission factor identification
		S*	9-16	Percent sulfur

*For liquified petroleum gas S is input as grains of sulfur per 10^4 cubic meters gas vapor.

Variable	Columns	
A	17-24	Percent ash
ANNUSF	25-32	Fuel usage, appropriate units (Table 8)
MCFLG	33-38	Emission control flag

Lease S and A input positions blank if they are not applicable.

Card 4 (2I4,9(I4,F4.3)) Read only if MCFLG ≠ 0

ID	1-4	Must agree with ID on card 2
NPLTCT	5-8	Number of pollutants controlled
IDPL(1)	9-12	Pollutant identification number (Table 18)
CNTRL(1)	13-16	Fraction that IDPL(1) is controlled
⋮	⋮	Etc. for remaining controlled pollutants
IDPL(NPLTCT)		
CNTRL(NPLTCT)		

Repeat cards 2, 3, and 4 (if needed) for each additional power plant source.

DATA SET 6.E -- Air Base incinerators (air base data sheets 6.E).

Card	Format	Variable	Columns	
Card 1	(I4)	NICS	1-4	Number of incinerator sources
Card 2				Point source data (Table 10) for each source, no defaults allowed
Card 3	(2I4,F8.2,I4)			
		ID	1-4	Must agree with ID on card 2
		MFCID	5-8	Incinerator emission factor ID number (Table 19)
		ANNUSF	9-16	Metric tons of trash corresponding to MFCID incinerated per year
		MCFLG	17-20	Emission control flag
Card 4	(2I4,9(I4,F4.2))			Read only if MCFLG ≠ 0
		ID	1-4	Must agree with ID on card 2
		NPLTCT	5-8	Number of pollutants controlled
		IDPL(1)	9-12	Pollutant identification number (Table 18)

Table 18

Pollutant Identification Names and Numbers

Pollutant	Computer Name	Identification Number
Carbon Monoxide	CO	1
Total Hydrocarbons	HC	2
Oxides of Nitrogen	NOX	3
Particulate Matter	Pt	4
Oxides of Sulfur	SOX	5
Additional Pollutants		6 - 9

Table 19

Incinerator Emission Factor Identification Numbers

Type of Load	Emission Factor Identification Number
Pathological	1
Paper - Single Chamber	2
Paper - Multiple Chamber	3
Film - Single Chamber	4
Film - Multiple Chamber	5

Activity input as annual metric tons of charge.

Variable	Columns	
CNTRL(1)	13-16	Fraction that IDPL(1) is controlled
⋮	⋮	Etc. for other controlled pollutants
IDPL(NPLTCT)		
CNTRL(NPLTCT)		

Repeat cards 2, 3, and 4 (if needed) for each incinerator.

DATA SET 6.F -- Storage tank point sources (air base data sheets 6.F).

Card	Format	Variable	Columns	
Card 1	(I4)	NSTS	1-4	Number of storage tank sources
Card 2				Point source data (Table 10) for items 1-7 (stack parameters not applicable)
Card 3	(I4,4X,2I4,5F8.4)			
		ID	1-4	Must agree with ID on card 2
		IDFUEL	9-12	Fuel identification number (Table 20)
		IROOF	13-16	Roof identification number (1 or 2)
		ANNUSE	17-24	Annual throughput in kiloliters
		CAP	25-32	Tank capacity in kiloliters
		TTMP	33-40	Tank temperature (°F) of the fuel, default to ambient if left blank
		TMPDIF	41-48	Daily average temperature variation (°F) of the tanks vapor space above the liquid fuel, default to ambient variation if left blank
		DIAM	49-56	Tank diameter in meters
Card 4a	(2I4,4F8.4)			Read if IROOF = 1 (fixed roof)
		ID	1-4	Must agree with ID on card 2
		NTANKS	5-8	Number of tanks of same size at this source
		HVS*	9-16	Average height of vapor space in meters (default assumed half of tank height)
		C1*	17-24	Throughput factor (default is 1.0)
		C2*	25-32	Paint factor (default is 1.2)
		C3*	33-40	Tank diameter factor (default is 1.0)

*Leave blank if wish to use default value.

Table 20

Fuel Identification Names and Numbers

Fuel	Computer Name	Identification Number
Automotive Gasoline	AMG	1
Jet Fuel JP-4	JP4	2
Aviation Gas	AVG	3
Diesel Fuel	DESL	4

	Variable	Columns	
Card 4b (2I4,3F8.4)			Read if IROOF = 2 (floating roof)
	ID	1-4	Must agree with ID on card 2
	NTANKS	5-8	Number of tanks of same size at this source
	C1	9-16	Rivet factor (blank means default of 0.1)
	C2	17-24	Seal factor (blank means default of 1.0)
	C3	25-32	Paint factor (blank means default is 1.0)

Repeat cards 2, 3, and 4a or 4b for each storage tank point source.

Note: If there are several large tanks of the same size in close proximity they can, if desired, be input as one point source with a ΔY set equal to the diameter of a circle enclosing the tanks; this is the reason NTANKS must be input.

DATA SET 6.G -- Any other air base point sources.

	Variable	Columns	
Card 1 (I4)	NXS	1-4	Number of other point sources
Card 2			Point source data (Table 10) for first source, no defaults are allowed
Card 3			Emissions data (Table 9) for first source

Repeat cards 2 and 3 for all of the NXS sources.

THIS COMPLETES THE AIR BASE POINT SOURCES

Data set 7 consists of the air base area sources listed in Table 7, column 3. These are fairly complex, and care should be taken to keep the data in order. First, the area source geometries are input followed by the various activities listed in Table 7, assigned to these geometries.

1) Identification numbers of air base area sources start with 3001.

DATA SET 7.A -- Air base area source geometries (air base data sheets 7.A).

	Variable	Columns	
Card 1 (I4)	NMAX	1-4	Number of air base area sources. If the number = 0, go to Data Set 8.8
Card 2			Area source data (Table 11), with a default of ΔZ = 8m when it is left blank on input card

Repeat card 2 for all of the NMAX area sources

DATA SET 7.B -- Hydrocarbon filling or working losses and spillage (see air base data sheets 7.B).

	Variable	Columns	
Card 1 (I4)	NWRK	1-4	Number of area sources with this type of emission

	Variable	Columns	
Card 2 (I4,4X,9F8.2)			
	ID	1-4	Must agree with an ID specified in data set 7.A
	YRUSE(1) ⋮ YRUSE(4)	9-16	Kiloliters of fuel types 1-4 processed at this source per year (Table 20)
	CC(1) ⋮ CC(4)	:	Estimates of a throughput factor for each of the 4 fuel types, blank means default value of 1.0 is used
	SPILL	:	Estimate of the annual metric tons of fuel of all types spilled in the area source

Repeat card 2 for all of the NWRK sources.

DATA SET 7.C -- Hydrocarbon breathing losses from petroleum storage tanks (air base data sheets 7.C).

	Variable	Columns	
Card 1 (I4)	NMAXE	1-4	Number area sources considered
Card 2a (4I4,4F8.2)		1-4	For fixed roof tanks
	ID	5-8	Must agree with an ID specified in data set 7.A
	IDFUEL	9-12	Fuel identification number (Table 20)
	IDROOF	13-16	Roof identification number of 1
	NTANKS	17-24	Number of tanks of this diameter in the area
	DIAM	25-32	Average tank diameter (m) for storage tanks in the area
	C1	33-40	Paint factor (blank means default of 1.2)
	C2	41-38	Tank diameter factor (blank means default of 1.0)
	HVS	49-56	Average height of vapor space in meters (no default)
Card 2b (4I4,4F8.2)			For floating roof tanks
	ID	1-4	Must agree with an ID specified in data set 7.A
	IDFUEL	5-8	Fuel identification number (Table 20)
	IDROOF	9-16	Roof identification must be 2
	NTANKS	17-24	Number of tanks of this approximate diameter in the area
	DIAM	25-32	Average tank diameter (m) for storage tanks in the area

Variable	Columns	
C1	33-40	Paint factor (blank means default of 1.0)
C2	41-48	Seal factor (blank means default of 1.0)
C3	49-56	Rivet factor (blank means default of 0.1)

Repeat card 2a or 2b for all of the NMAXE sources.

DATA SET 7.D -- Tank truck parking area hydrocarbon breathing losses (air base data sheet 7.D).

Card	Format	Variable	Columns	
Card 1	(I4)	NMAXE	1-4	Number of tank truck parking areas
Card 2	(3I4,4X,3F8.2)			
		ID	1-4	Must agree with an ID specified in data set 7.A
		IDFUEL	5-8	Fuel ID number (Table 20)
		NTRKS	9-12	Number of tank trucks parked in area
		TNKCAP	17-24	Average tank capacity in kiloliters
		FRCFUL	25-32	Average fraction of tank filled
		DIAM	33-40	Average tank diameter in meters

Repeat card 2 for all of the NMAXE sources

DATA SET 7.E -- Military and civilian vehicle parking areas (air base data sheet 7.E).

Card	Format	Variable	Columns	
Card 1	(I4)	NMAXE	1-4	Number of sources
Card 2	(3I4,4X,2F8.2)			
		ID	1-4	Must agree with an ID specified in data set 7.A
		IDFUEL	5-8	Fuel identification number (Table 20)
		NVEH	9-12	Number of vehicles parked in area
		TNKCAP	17-24	Average capacity of vehicle tanks (liters)
		FRCFUL	25-32	Average fraction of tank filled

Repeat card 2 for all of the NMAXE sources.

DATA SET 7.F -- Evaporative hydrocarbons from other sources.

Card	Format	Variable	Columns	
Card 1	(I4)	NXEVP	1-4	Number of sources
Card 2	(I4,4X,F8.2)			
		ID	1-4	Source ID number must agree with an ID of data set 7.A
		ANNEM	9-16	Annual hydrocarbon emission in metric tons

Repeat card 2 for all of the NXEVP sources.

DATA SET 7.G -- Space heating sources (air base data sheet 7.G).

		Variable	Columns	
Card 1	(I4)	NSHS	1-4	Number of space heating area sources
Card 2	(2I4,3F8.2,I4)			
		ID	1-4	Must agree with an ID specified in data set 7.A
		IDEMFC	5-8	Emission factor ID number, depends on fuel and average furnace size (Table 8)
		S	9-16	Average percent sulfur in fuel
		A	17-24	Average percent ash in fuel
		ANNUSE	25-32	Annual consumption in units appropriate to emission factors (Table 8)
		ICNTRL	33-36	Emission control flag
Card 3	(2I4,9(I4,F4.3))			Input if ICNTRL $\neq$ 0
		ID	1-4	Must agree with ID on card 2
		NPLTCT	5-8	Number of pollutants controlled
		IDPL(1)	9-12	ID number (Table 18) of controlled pollutant number 1 and fraction it is controlled
		CNTR(1)	13-16	
		⋮	⋮	Etc., for other controlled pollutants
		IDPL(NPLTCT)		
		CNTR(NPLTCT)		

Repeat cards 2 and 3 (if needed) for each of the NSHS space heating sources.

DATA SET 7.H -- Off-road vehicle sources (air base data sheet 7.H).

		Variable	Columns	
Card 1	(I4)	NORVHS	1-4	Number of off-road vehicle sources
Card 2	(I4,4X,F8.2)			
		ID	1-4	Must agree with an ID specified in data set 7.A
		ANNGAL	9-16	Annual diesel consumption in area in kilogallons

Repeat card 2 for all of the NORVHS off-road sources.

DATA SET 7.I -- Military vehicle area sources (air base data sheet 7.I).

		Variable	Columns	
Card 1	(I4)	NMVHAR	1-4	Number of military vehicle area sources on the air base
Card 2			1-4	Vehicle data (Table 14)

Repeat card 2 for each of the NMVHAR area sources.

DATA SET 7.J -- Civilian vehicle area sources (air base data sheet 7.J).

		Variable	Columns	
Card 1	(I4)	NCVHAR	1-4	Number of civilian vehicle area sources on the base
Card 2			1-4	Vehicle data (Table 14)

Repeat card 2 for each of the NCVHAR area sources.

Note: Each area geometry defined by data set 7.A may contain emissions from more than one source as defined by the activities in data sets 7.B-J.

END OF AIR BASE AREA SOURCE INPUT DATA

Data set 8 is the air base line source data and will conclude the air base input data. The input is similar to the air base area source input in that the line source geometries are first defined followed by input of the activity of various kinds occurring on these sources.

1) Air base line source identification numbers start with number 4001.

DATA SET 8.A -- Air base non-aircraft line source geometries (air base data sheet 8.A).

		Variable	Columns	
Card 1	(I4)	NMAX	1-4	Number of air base line sources
Card 2			1-4	Line source data (Table 13) with defaults of ΔY = 10.0 m and ΔZ = 2.0 m when corresponding elements are left blank

Repeat card 2 for each of the NMAX air base line sources.

DATA SET 8.B -- Air base military vehicle line activities (air base data sheet 8.B).

		Variable	Columns	
Card 1	(I4)	NMVHLN	1-4	Number of military vehicle line sources
Card 2			1-4	Vehicle data (Table 14)

Repeat card 2 for each military vehicle line source.

DATA SET 8.C -- Air base civilian vehicle line activities (air base data sheet 8.C).

		Variable	Columns	
Card 1	(I4)	NCVHLN	1-4	Number of civilian vehicle line sources
Card 2			1-4	Vehicle data (Table 14)

Repeat card 2 for each civilian vehicle line source.

DATA SET 8.D -- Other air base non-aircraft line sources (air base data sheet 8.D).

		Variable	Columns	
Card 1	(I4)	NXLN	1-4	Number of other non-aircraft line sources
Card 2			1-4	Emissions data (Table 9)

Repeat card 2 for each of the NXLN sources.

Note: Each line defined by data set 8.A may contain emissions from more than one source as defined in 8.B-D.

END OF AIR BASE LINE SOURCE INPUT

Data set 9 is the environ source emission inventory (Section III.9). It consists of three subsets of data input corresponding to the point, area, and line sources, respectively. Since much of the input data have common meanings and formats, use will be made of various basic input formats as defined by Tables 9, 10, 11, 13, and 14.

DATA SET 9.A -- Environ point sources (refer to environ data sheets 9.A and 9.D).

1) Source identification numbers start at 1001.

		Variable	Columns	
Card 1	(I4)	NMAX	1-4	Number of environ point sources
Card 2				Point source data for first source (Table 10), no defaults provided
Card 3				Emissions data (Table 9) for first source

Repeat above 2 cards for each of the other NMAX sources.

DATA SET 9.B -- Environ area sources (refer to environ data sheets 9.B-D and, if necessary, 9.E.1 and 2).

1) Source identification numbers start at 1301.

2) Input depends on option selected on first card.

Card	Format	Variable	Columns	Description
Card 1	(I4)	IOPT	1-4	= 0 No environ area source input, go to data set 9.C
				= 1 Consider stationary and mobile area sources separately
				= 2 Use land-use based emission factors
				= 3 Combine area sources, input total emissions

If IOPT = 1:

Card	Format	Variable	Columns	Description
Card 2	(I4)	$NMAX_1$	1-4	Number of environ stationary area sources
Card 3				Area source data (Table 11) for first source, allowing default of 8 m if ΔZ left blank
Card 4				Emissions data (Table 9) for first source

Repeat cards 3 and 4 for all of the NMAX sources.

Card	Format	Variable	Columns	Description
Card $2 \times NMAX_1+3$	(I4)	$NMAX_2$	1-4	Number of environ mobile area sources
Card $2xNMAX_1+4$				Area source data for first source (Table 11) allowing default of 2 m if ΔZ left blank
Card $2xNMAX_1+5$				Vehicle data for each source (Table 14)

Repeat above 2 card sets for all of the $NMAX_2$ sources.

If IOPT = 2: See environ data sheet 9.B.2

Card	Format	Variable	Columns	Description
Card 2	(I4)	NMAX	1-4	Number of land-use area sources
Card 3				Area source data (Table 11), for first source, default of 8 m if ΔZ left blank
Card 4	(I4,4X,8F8.7)			
		ID	1-4	Must agree with ID on card 3
		$FRCTLU_1$	9-16	Fractions of land use in each of 8 NREC categories (Table 12) for first source
		⋮	⋮	
		$FRCTLU_n$		

Repeat abo.. 2 cards for all of the NMAX sources.

If IOPT = 3:

Card	Format	Variable	Columns	Description
Card 2	(I4)	NMAX	1-4	Number of environ combined area sources
Card 3				Area source data (Table 11) for first source allowing default of 8 m if ΔZ left blank
Card 4				Emissions data (Table 9) for first source

Repeat above 2 cards for all of the NMAX sources.

DATA SET 9.C -- Environ line source data (refer to environ data sheets 9.C, 9.D, and 9.E.1 and 2).

1) Source identification numbers start at 1801.

		Variable	Columns	
Card 1	(I4)	$NMAX_1$	1-4	Number of roadway line sources
Card 2				Line source data for first source (Table 13) allowing defaults for ΔY and ΔZ of 10 m and 2 m when they are left blank
Card 3				Vehicle data for first source (Table 14)

Repeat above 2 cards for all of the $NMAX_1$ sources.

Card $2xNMAX_1+3$				
	(I4)	$NMAX_2$	1-4	Number of non-roadway line sources
Card $2xNMAX_1+4$				Line source data (Table 13) for first non-roadway line source allowing defaults for ΔY and ΔZ of 10 m and 2 m when left blank
Card $2xNMAX_1+5$				Emissions data for first source (Table 9)

Repeat above 2 cards for all of the $NMAX_2$ sources.

END OF SOURCE INVENTORY INPUT

SECTION IV

TIME PERIOD EMISSION/DISPERSION PROGRAMS

These user-operated programs read the Master Source Magnetic Tape plus additional input data and compute the concentration of atmospheric pollutants (user chooses which ones) on either a short-term or long-term basis depending on which model is used.

IV.1 PROGRAM OVERVIEW

The program structure is illustrated in Figure 4. It consists of two major models driven by MAINL and MAINS each with a similar driving routine called MAIN which sets up the general problem.

Programs MAIN read in receptor and various other general data, direct subroutine READ to read the master source emission tape, and then directs control to MAINL or MAINS depending on whether the long or short-term model is being used. MAINL is the principal driver for the long-term model. It reads the meteorological data tape, calls the source emission routine SOURCE then directs control to subroutine DIFMOD which is a subdriver for the dispersion routines. DIFMOD sets up the wind direction and wind speed loops for the climatological/dispersion calculation, calls the wind condition dependent source subroutine ACSRCE and then calls the point and area source dispersion model coded by subroutine POLUT and the line source dispersion model coded by subroutine POLUTL. The dispersion codes POLUT and POLUTL compute the pollutant concentrations for each source-receptor pair for each set of meteorological variables.

MAINS is the principal driver of the short-term model. It sets up an hour loop, reads in the hourly values of the meteorological variables, calls the source routines SOURCE and ACSRCE, and then calls the subdriver POLSOR. POLSOR in turn calls the point and area source dispersion model coded in subroutine STPOL1 and the line source dispersion model coded in subroutine STPOL2. Each of these latter codes compute the concentration of the pollutants for each source-receptor pair for each hour.

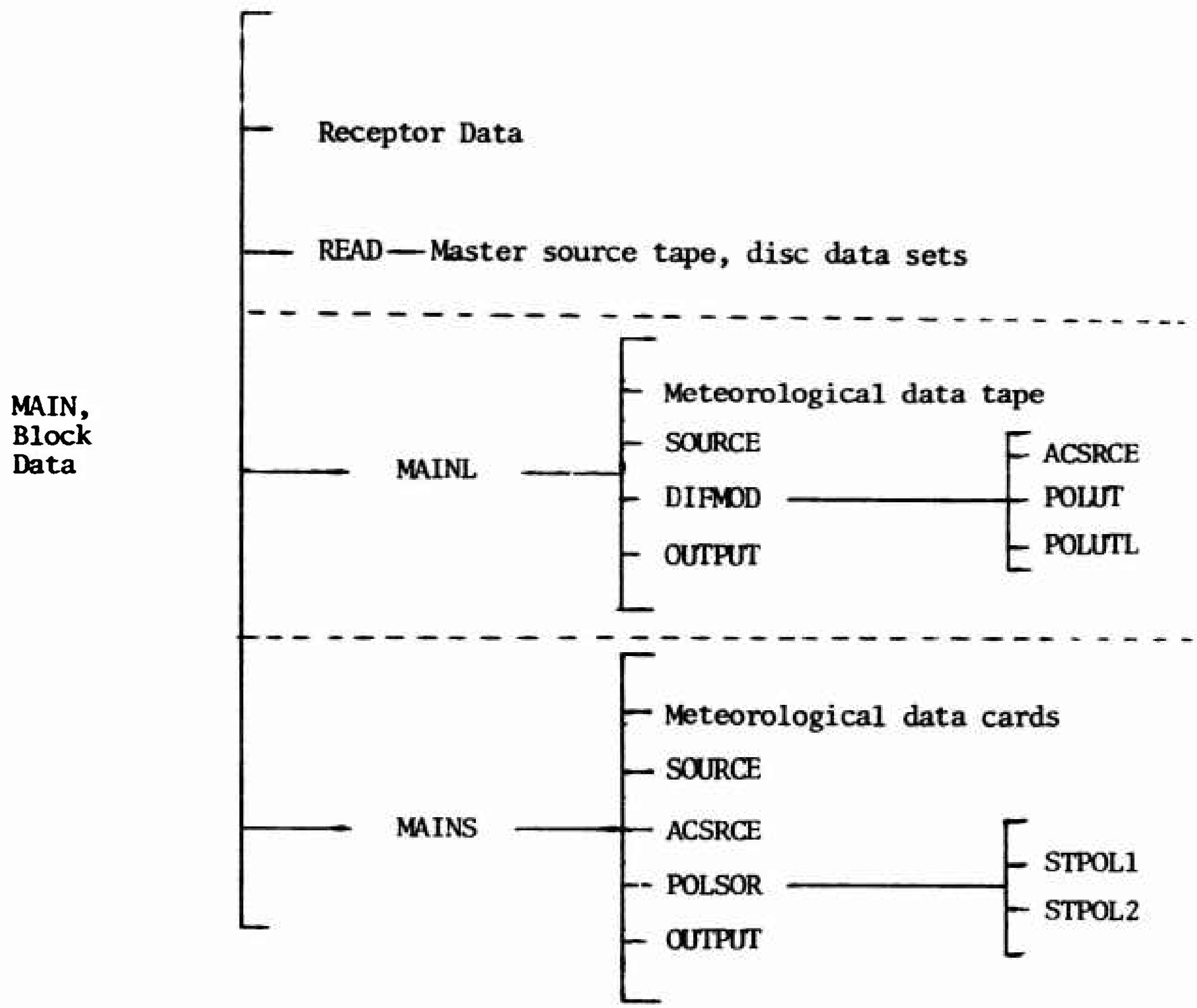


Figure 4. Macro-flow chart for time period emission/dispersion programs.

Subroutine SOURCE is a source routine which places in labeled common blocks all sources which do not depend upon the wind direction or wind speed. It also computes the hourly emission rates for those sources based upon either a default diurnal pattern or a user-input pattern.

Subroutine ACSRCE is a source routine which places in labeled common blocks all sources which depend on the wind direction and/or the wind speed. It also computes the hourly emission rates in a similar manner to subroutine SOURCE.

IV.2 GENERAL OPERATING INSTRUCTIONS

To use the Time Period Emission/Dispersion Programs the user must proceed as follows:

- Decide upon either a long-term or a short-term calculation.
  - Short -- hourly computations of the air quality.
  - Long -- monthly average computations of the air quality using the meteorological data tape prepared by ETAC.
- Prepare the input data list.
  - Short-term calculation -- go to Section IV.3.
  - Long-term calculation -- go to Section IV.4.

IV.3 INPUT DATA LIST FOR THE SHORT-TERM MODEL

When using the short-term model card input must be supplied in the following order:

Type 1 data consists of general problem input. Type 2 data defines a period. A period is a group of consecutive hours in one month for which calculations are to be made. Type 3 data defines the meteorological data and time distribution data for each hour of the period. The type 3 data is repeated for each hour of the period defined by the type 2 data. The type 2 data is repeated for each period defined by the type 1 data.

TYPE 1 DATA -- GENERAL PROBLEM DESCRIPTION

Card Number	Variable	Column	Description	Format
1	(TITLE1(I), I=1,20)	1-20	Problem title	20A4
2	NXPOL*	1-6	Number of extra pollutants	I6,5A8
	(XNAME(I), I=1,NXPOL)*	7-14 ⋮	Output headings for the extra pollutants	
3	(IPCHOS(I), I=1,10)	1-6 ⋮	Pollutant numbers for which output is to be printed Number — Pollutant 1 — CO 2 — HC 3 — NO_x 4 — Particulate 5 — SO_2	10I6
4	NCASE+	1-6	Number of special cases of wind speed and direction to be defined ($\leq$ 3)	I6,6F6.0
	(WDSP(I),WSSP(I), I=1,NCASE)	7-12 ⋮	Value of the wind direction (degrees) and wind speed (knots) which define a special case	
5	XBASE	1-6	X coordinate of the lower left hand corner of the receptor grid (kilometers)	2F6.0, 2I6,F6.0
	YBASE	7-12	Y coordinate of the lower left hand corner of the receptor grid (kilometers)	
	INCRX	13-18	Number of columns of grid receptors	
	INCRY	19-24	Number of rows of grid receptors	
	DELTA	25-30	Spacing between rows and columns (kilometers)	
6	IADD	1-6	Number of off-grid receptors to be defined. (Maximum of 12.) NOTE: for each off-grid receptor, the following card must be supplied. If IADD equals zero, no additional cards are needed	

*This option is not available at present. These variables should be left blank.

+See footnote on page 41.

Card Number	Variable	Column	Description	Format
7,7+IADD	XRECEP	1-6	X coordinate of an off-grid receptor (kilometers)	2F6.0
	YRECEP	7-12	Y coordinate of an off-grid receptor (kilometers)	
7+IADD+1	IMONTH	1-6	The ID number of the month in which all periods occur	3I6,1F6.0
	NODAYS	7-12	The number of days in the month, IMONTH	
	NPER	13-18	The number of different periods to be considered, each must contain only consecutive hours and be in the month, IMONTH	
	TMBAR	19-24	Average temperature during IMONTH in degrees Fahrenheit	

TYPE 2 DATA* -- PERIOD DEFINITION CARD INPUT

This data is repeated NPER (see type 1 data) times.

Card Number	Variable	Column	Description	Format
1	NHOUR	1-6	The number of hours in the period	2I6
	IDAY	7-12	= 1 Period occurs during weekday = 2 Period occurs during weekend	

TYPE 3 DATA* -- METEOROLOGICAL AND TIME DISTRIBUTION INPUT CARDS

The type 3 data on the following several pages must be input for each of the NHOUR hours, i.e., every hour for which an hourly calculation is desired. The first NHOUR cards contain the hour of the day, the stability category, etc., one card for each set of meteorological data. The remaining cards refer to the temporal distribution of the annual air base and environ emissions and as such must be input at least for the first hour. Subsequent hours may be given the same non-aircraft emission rate as the first hour by setting the appropriate flag (JFLAG).

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*Note that NHOUR and IDAY are input for the first of the NPER periods followed by the type 3 input for each of the NHOUR hours, then NHOUR and IDAY are input for the second of the NPER periods and again followed by the type 3 input for each of hours in period 2, etc.

The following points should be made:

1) The criteria values referred to were set from user input in the source inventory model and if the number of relevant source is equal to zero, then none of the corresponding data is input.

2) Whenever sources of a given type are being changed independently, e.g., the first set of input for environ point sources, cards la and lb, the ID's of the sources being changed <u>must be</u> progressively larger numbers.

3) When the variable UNIFRC is set, the fraction of emissions not uniformly distributed (1.0-UNIFRC) is distributed by a degree-hour method.

4) The definitions of FMO, FDY and FHR are:

FMO	Fraction of total annual emissions that occur during month under consideration.
FDY	Fraction of total weekly emissions (or activity) that occurs on the day under consideration, i.e., this is to distinguish between weekday and weekend emissions.
FHR	Fraction of daily emissions or activity that occurs in the hour under consideration (if a time period greater than one hour is being considered, this fraction still applies to activity on an hourly basis).

5) Defaults for FDY and FMO are 1/7 and 1/12, respectively while default for FHR is either 1/24, 1/12 or 0 depending on the particular case. If one or two of these quantities are blank on one card, the defaults are used. If all three quantities are blank, the source or sources the card applies to are assumed to have a zero emission.

Repeat following hourly meteorological data NHOUR times before proceeding to temporal distribution data input.

Criteria	Card Number	Variable	Column	Description	Format
Always present	1	KRH	1-6	The hour of the day, e.g., for time 0800-0859 KRH = 9	2I6,4F6.0
		JSTAB	7-12	Stability category (1, 2, 3 etc.)	
		WS	13-18	Wind speed (meters/ second)	
		WD	19-24	Wind direction during hour KRH ignored if WS < 1.0	

Criteria	Card Number	Variable	Column	Description	Format
	1 (cont'd)	TEMP	25-30	Temperature (^{o}F)	
		HLID	31-36	Mixing depth (meters)	

Repeat above NHOUR times, one card for each hour before proceeding to JFLAG.

One value of JFLAG and then the succeeding time distribution cards are input for the first hour, then the value of JFLAG for the second hour, etc. over NHOUR hours.

START INPUT OF TEMPORAL DISTRIBUTION DATA

Criteria	Card Number	Variable	Column	Description	Format
Always present	2	JFLAG*		=-1, use default time distributions (see footnote);** =0, time distribution cards must be input; =1, emissions from previous time period used for non-aircraft sources	I4

Input the following only if JFLAG = 0.

IF NO AIR BASE POINT SOURCES, SKIP TO AIR BASE AREA SOURCES (CARDS 4)

Criteria	Card Number	Variable	Column	Description	Format
NTFS≠0 number training fire sites	3a	ICLAS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 101 Activity fractions for training fires	I4,4X, 3F8.7
NTCS≠0 number test cells	3b	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 102 Activity fractions for test cells	I4,4X, 3F8.7
NRUS≠0 number run-up stands	3c	ICLASS FHR, FDY, FMO	1-4 9-16 ⋮	ICLASS must be 103 Activity fractions for run-up stands	I4,4X, 3F8.7

*JFLAG must be either -1 or 0 for at least the first hour of the first time period, however if for subsequent hours JFLAG is 1, the non-aircraft emissions for these hours will be the same as for the preceding hour, whereas aircraft emissions are determined for the current time period using the aircraft temporal distirbution arrays.

**The JFLAG = -1 option is provided to allow the user to run the model without inputting any of the temporal distribution data on pages 70-73 (pages 76-79 for long term model). The value of UNIFRC in this instance is 0.1 for all cases of source classes for which it is used to distribute emissions in time.

Criteria	Card Number	Variable	Column	Description	Format
NPPS≠0 number air base power plants	3d	ICLASS, NPTC	1-4 5-8	ICLASS must be 104 Number of air base plants not using defaults of a uniform distribution	2I4
	3e-3e+NPTC	ID, FHR, FDY, FMO	1-4 9-16 ⋮	Activity fractions for power plant source ID	I4,4X, 3F8.7
NICS≠0 number air base incinerators	3f	ICLASS	1-4	ICLASS must be 105 Number of air base incinerators not using default of a uniform distirbution	2I4
	3g-3g+NPIC	ID, FHR, FDY, FMO	1-4 9-16 ⋮	Activity fractions for incinerator source ID	I4,4X, 3F8.7

Criteria	Card Number	Variable	Column	Description	Format
NXS≠0 number air base point sources in other category	3h	ICLASS, NPTC	1-4 5-9	ICLASS must be 107 Number of other air base point sources not using default of uniform distribution	2I4
	3h-3h+NPTC	ID,FHR, FDY,FMO	1-4 9-16	Activity fractions for other air base point source ID	I4,4X, 3F8.7

IF NO AIR BASE AREA SOURCES, SKIP TO AIR BASE LINE SOURCES (CARDS 5)

Criteria	Card Number	Variable	Column	Description	Format
NXEVP≠0	4a	IMETH	1-4	Index indicating whether cards 5b and 5c or card 5d will follow for the time distribution of evaporated hydrocarbons in the other category	I4
Option of one or the other: IMETH=1	4b	ICLASS, NPTC	1-4 5-8	ICLASS must be 110 Number of other evaporative hydrocarbon, air base area sources not using default of a uniform distribution	2I4
	4c-4c+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Activity fraction for evaporative hydrocarbon source ID	I4,4X, 3F8.7
IMETH=2	4d	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 110 Activity fraction for other evaporative hydrocarbon sources	I4,4X, 3F8.7
NSHS≠0 number of area sources with space heating emissions	4e	ICLASS, UNIFRC	1-4 9-16	ICLASS must be 111 Fraction of the space heating emissions which are distributed uniformly	I4,4X, F8.7
NORVHS≠0 number of off-road vehicle sources	4f	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 112 Activity fraction for off-road vehicles	I4,4X, 3F8.7

IF NO AIR BASE LINE SOURCES, SKIP TO ENVIRON SOURCES (CARDS 6)

Criteria	Card Number	Variable	Column	Description	Format
NXLN≠0 number of air base non-roadway lines	5a	IMETH		Index indicating whether cards 3b and 3c or card 3d will follow	I4

Criteria	Card Number	Variable	Column	Description	Format
Option of one or the other: IMETH=1	5b	ICLASS, NPTC	1-4 5-8	ICLASS must be 117 Number of other air base non-roadway line sources not using defaults of uniform distribution	2I4
	5c-5c+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Activity fractions for non-aircraft line source ID	I4,4X, 3F8.7
IMETH=2	5d	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 117 Activity fraction for other non-aircraft line sources	I4,4X, 3F8.7
IF NUMBER OF ENVIRON SOURCES IS ZERO, INPUT IS COMPLETE					
NENPT≠0 (No. of environ point sources)	6a	ICLASS, NPTC	1-4 5-8	ICLASS must be 201 Number of environ point sources not using defaults	2I4
	6b-6b+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Hourly, daily and monthly activity fractions for point source ID	I4,4X, 3F8.7
NMAX1≠0, IOPT=1	7a*	ICLASS, UNIFRC	1-4 9-16	ICLASS must be 202 Fraction of emissions from NMAX1 stationary environ area sources which are distributed uniformly	I4,4X, F8.7
NMAX1≠0, IOPT=2 or 3 (No. of environ area sources)	7b	IMETH	1-4	Index indicating whether cards 7c and 7d or card 7e will follow	I4
IMETH=1 (sources treated independently)	7c	ICLASS, NPTC	1-4 5-8	ICLASS must be 203 or 204 Number of environ area sources not using defaults of uniform distribution	2I4
	7d-7d+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Hourly, daily and monthly activity fractions for area source ID	I4,4X, 3F8.7
IMETH=2 (same fractions used for all sources)	7e	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 203 or 204 Hourly, daily and monthly activity fractions for the environ area sources	I4,4X, 3F8.7

*Note that of card sets 7, either 7a; or 7b; 7c and 7d; or 7b and 7e are input.

Criteria	Card Number	Variable	Column	Description	Format
NMAX2≠0 (No. environ non-roadway lines)	8a	IMETH	1-4	Index indicating whether cards 6b and 6c or card 6d will follow	I4
Option of one or the other: IMETH =1	8b	ICLASS NPTC	1-4 5-8	ICLASS must be 206 Number of non-roadway line sources not using defaults of uniform distribution	2I4
	8c-8c+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Hourly, daily and monthly activity fractions for area source ID	I4,4X, 3F8.7
IMETH =2	8d	ICLASS FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 206 Hourly, daily and monthly activity fractions for non-roadway line sources	I4,4X, 3F8.7

Repeat the above for each of the NHOUR hours in the current time period.

END OF TYPE 3 TIME DEPENDENT SOURCE DATA

IV.4 INPUT DATA LIST FOR LONG-TERM MODEL

When using the long-term model, card input must be supplied in the following order. Type 1 data is general problem input. Type 2 data describes months and periods of day for which calculations are to be made. Type 3 data defines the time distribution factors to be applied to the annual emissions for each combination of month and period of day specified by the type 2 data.

TYPE 1 DATA -- MAIN PROGRAM CARD INPUT.

Card Number	Variable	Column	Description	Format
1	(TITLE(I),I=1,20)	1-4	Problem title	20A4
1a	IRPR IRMN IRWS IRWD	1-6 7-12 13-18 19-24	Restart card containing ID's for the period, month, wind speed and wind direction respectively identifying conditions under which calculations are to resume. A blank card is used for a new run	4I6
2	NXPOL*	1-6	Number of extra pollutants	I6,5A8
	(XNAME(I),NXPOL)*	7-14 ⋮	Output headings for the extra pollutants	

Card Number	Variable	Column	Description		Format
3	(IPCHOS(I),I=1,10)		Pollutant numbers for which output is to be printed		10I6
			Number	Pollutant	
		1-6	1	CO	
		7-12	2	HC	
		13-18	3	NO_x	
		19-24	4	Particulate	
		25-30	5	SO_2	
4	NCASE*	1-6	Number of special cases of wind speed & direction to be defined		I6,6F6.0
	(WDSP(I),WSSP(I), I=1, NCASE)	7-12 :	Value of the wind direction & wind speed (knots) which define a special case		
5	XBASE	1-6	X coordinate of the lower left hand corner of the receptor grid (kilometers)		2F6.0, 2I6,F6.0
	YBASE	7-12	Y coordinate of the lower left hand corner of the receptor grid (kilometers)		
	INCRX	13-18	Number of columns of grid receptors		
	INCRY	19-24	Number of rows of grid receptors		
	DELTA	25-30	Spacing between rows and columns (kilometers)		
6	IADD	1-6	Number of off-grid receptors to be defined. Note: for each off-grid receptor one of the following cards must be supplied. If IADD equals zero, no additional cards are needed.		I6
7,7+ IADD	XRECEP	1-6	X coordinate of an off-grid receptor (kilometers)		2F6.0
	YRECEP	7-12	Y coordinate of an off-grid receptor (kilometers)		

Note: Card 7 must be repeated IADD times.

TYPE 2 DATA -- LONG-TERM MODEL CARD INPUT.

1	IDAY	1-6	=1 Use weekday emission pattern	I6
			=2 Use weekend emission pattern	

*See footnote on page 41.

Card Number	Variable	Column	Description	Format
2	(IPR(I),I=1,7)*		Identification number for each period of day for which a calculation is to be made. Any number of periods from 1-7 may be chosen, but the period ID's must be progressively larger when more than one period is chosen.	7I6

Column	ID	Period of Day (LST)
1-6	1	0000 - 2400
7-12	2	0600 - 1800
13-18	3	0600 - 0900
19-24	4	0900 - 1500
25-30	5	1500 - 1800
31-36	6	1800 - 2100
37-42	7	2100 - 0600

Card Number	Variable	Column	Description	Format
3	(IMN(I),I=1,13)*		Identification number for each month for which a calculation is to be made. Any number of months from 1 to 12 may be chosen but the month ID's must be progressively larger where more than one month is chosen.	13I6

Column	ID	Month
1-6	1	January
7-12	2	February
13-18	3	March
19-24	4	April
25-30	5	May
31-36	6	June
37-42	7	July
43-48	8	August
49-54	9	September
55-60	10	October
61-66	11	November
67-72	12	December
73-78	13	Annual

TYPE 3 DATA -- SOURCE TEMPORAL DISTRIBUTION MODEL INPUT CARDS.

One set of type 3 input must be supplied for each combination of month and period of day as specified by the type 2 input. This input refers to the distribution in time of annual emissions for certain of the air base and environ sources and as such must be provided for at least the first time period. Subsequent time periods may be given the same non-aircraft emission rate as the first time period by setting JFLAG to the appropriate value.

*For example if calculations for February and June during the periods 0600-0900 and 1500-1800 were desired then IMN(1)=2, IMN(2)=6; IPR(1)=3 and IPR(2)=5 and other values would be left blank so equal to 0.

The following points should be made:

1) The criteria values were set from user input in the source inventory model and if the number of relevant sources is equal to zero, then none of the corresponding data is input.

2) It should be noted that whenever sources of a given type are being changed independently, e.g., the first set of input for environ point sources, cards 1a and 1b, that the ID's of the sources being changed must be progressively larger numbers.

3) When the variable UNIFRC is set, the fraction of emissions not uniformly distributed (1.0-UNIFRC) is distributed by a degree-hour method.

4) The definitions of FMO, FDY and FHR are:

   FMO — Fraction of total annual emissions that occur during month under consideration.

   FDY — Fraction of total weekly emissions (or activity) that occurs on the day under consideration, i.e., this is to distinguish between weekday and weekend emissions.

   FHR — Fraction of daily emissions or activity that occurs in the hour under consideration (if a time period greater than one hour is being considered, this fraction still applies to activity on an hourly basis).

Card sets 0 through 6 are input sequentially for each time period.

Criteria	Card Number	Variable	Column	Description	Format
Always present	1	JFLAG*	1-4	=-1, use default time distributions (see footnote** on page 70); =0, time distribution cards must be input; =1, emissions from previous time period used for non-aircraft sources.	I4

Input the following only if JFLAG = 0.

IF NO AIR BASE POINT SOURCES, SKIP TO AIR BASE AREA SOURCES (CARDS 3)

Criteria	Card Number	Variable	Column	Description	Format
NTFS≠0 number training fire sites	2a	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 101 Activity fractions for training fires	I4,4X, 3F8.7
NTCS≠0 number test cells	2b	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 102 Activity fractions for test cells	I4,4X, 3F8.7

*JFLAG must be either -1 or 0 for at least the first time period, however if for subsequent time periods JFLAG is 1 the non-aircraft emissions for subsequent time periods will be the same as for the preceding time period, whereas aircraft emissions are determined for the current time period using the aircraft temporal distribution arrays.

Criteria	Card Number	Variable	Column	Description	Format
NRUS≠0 number run-up stands	2c	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 103 Activity fractions for run-up stands	I4,4X, 3F8.7
NPPS≠0 number air base power plants	2d	ICLASS, NPTC	1-4 5-8	ICLASS must be 104 Number of air base power plants not using defaults of a uniform distribution	2I4
	2e-2e+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Activity fractions for power plant source ID	I4,4X, 3F8.7
NICS≠0 number air base incinerators	2f	ICLASS, NPTC	1-4 5-8	ICLASS must be 105 Number of air base incinerators not using default of a uniform distribution	2I4
	2g-2g+NPTC	ID, FHR, FDY,FMO	1-4 9-16	Activity fractions for incinerator source ID	I4,4X, 3F8.7
NXS≠0 number air base point sources in other category	2h	ICLASS, NPTC	1-4 5-8	ICLASS must be 107 Number of other air base point sources not using default of uniform distribution	2I4
	2h-2h+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Activity fractions for other air base point source ID	I4,4X, 3F8.7

IF NO AIR BASE AREA SOURCES, SKIP TO AIR BASE LINE SOURCES (CARDS 4)

Criteria	Card Number	Variable	Column	Description	Format
NXEVP≠0	3a	IMETH	1-4	Index indicating whether cards 5b and 5c or card 5d will follow for the time distribution of evaporated hydrocarbons in the other category	I4
Option of one or the other: IMETH =1	3b	ICLASS, NPTC	1-4 5-8	ICLASS must be 110 Number of other evaporative hydrocarbon, air base area sources not using default of a uniform distribution	2I4
	3c-3c+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Activity fraction for evaporative hydrocarbon source ID	I4,4X, 3F8.7
IMETH =3	3d	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 110 Activity fraction for other evaporative hydrocarbon sources	I4,4X, 3F8.7

Criteria	Card Number	Variable	Column	Description	Format
NSHS≠0 number of area sources with space heating emissions	3e	ICLASS, UNIFRC	1-4 9-16	ICLASS must be 111 Fraction of the space heating emissions which are distributed uniformly	I4,4X, F8.7
NORVHS≠0 number of off-road vehicle sources	3f	ICLASS, FHR, FDY, FMO	1-4 9-16 ⋮	ICLASS must be 112 Activity fraction for off-road vehicles	I4,4X, 3F8.7

IF NO AIR BASE LINE SOURCES, SKIP TO ENVIRON SOURCES (CARDS 5)

Criteria	Card Number	Variable	Column	Description	Format
NXLN≠0 number of air base non-roadway lines	4a	IMETH	1-4	Index indicating whether cards 3b and 3c or card 3d will follow	I4
Option of one or the other: IMETH =1	4b	ICLASS, NPTC	1-4 5-8	ICLASS must be 117 Number of other air base non-roadway line sources not using defaults of uniform distribution	2I4
	4c-4c+NPTC	ID,FHR, FDY,FMO	1-4 9-16	Activity fractions for non-aircraft line source ID	I4,4X, 3F8.7
IMETH =2	4d	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 117 Activity fraction for other non-aircraft line sources	I4,4X, 3F8.7

IF NUMBER OF ENVIRON SOURCES IS ZERO, INPUT IS COMPLETE

Criteria	Card Number	Variable	Column	Description	Format
NENPT≠0 (No. of environ point sources)	5a	ICLASS, NPTC	1-4 5-8	ICLASS must be 201 Number of environ point sources not using defaults	2I4
	5b-5b+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Hourly, daily and monthly activity fractions for point source ID	I4,4X, 3F8.7
NMAX1≠0, IOPT=1	6a	ICLASS, UNIFRC	1-4 9-16	ICLASS must be 202 Fraction of emissions NMAX1 stationary environ area sources which are distributed uniformly	I4,4X, F8.7

Criteria	Card Number	Variable	Column	Description	Format
NMAX1≠1 IOPT=2 or 3 (No. of environ area sources)	6b	IMETH	1-4	Index indicating whether cards 2c and 2d or card 2e will follow	I4
IMETH=1 (sources treated independently)	6c	ICLASS, NPTC	1-4 5-8	ICLASS must be 203 or 204 Number of environ area sources not using defaults of uniform distribution	2I4
	6d-6d+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Hourly, daily and monthly activity fractions for area source ID	I4,4X, 3F8.7
IMETH=2 (same fractions used for all sources)	6e	ICLASS, FHR,FDY, FMO	1-4 9-16	ICLASS must be 203 or 204 Hourly, daily and monthly activity fractions for the environ area sources	I4,4X, 3F8.7
NMAX2≠0 (No. environ non-roadway lines)	7a	IMETH	1-4	Index indicating whether cards 6b and 6c or card 6d will follow	I4
Option of one or the other: IMETH =1	7b	ICLASS, NPTC	1-4 5-8	ICLASS must be 206 Number of non-roadway line sources not using defaults of uniform distribution	2I4
	7c-7c+NPTC	ID,FHR, FDY,FMO	1-4 9-16 ⋮	Hourly, daily and monthly activity fractions for area source ID	I4,4X, 3F8.7
IMETH =2	7d	ICLASS, FHR,FDY, FMO	1-4 9-16 ⋮	ICLASS must be 206 Hourly, daily and monthly activity fractions for non-roadway line sources	I4,4X, 3F8.7

Note that of card sets 6, either 6a; or 6b, 6c and 6d; or 6b and 6e are input.

END OF TYPE 3 TIME DEPENDENT SOURCE DATA

REFERENCES

1. "Handbook of Air Pollutant Emissions from Transportation Systems," R. R. Cirillo and T. D. Wolsko, ANL/ES-28, September 1973.

2. Journal of Air Pollution Control Association, 21(5), 260(1971).

3. "The Potential Impact of Aircraft Emissions Upon Air Quality," M. Platt, et al., NREC Report No. 1167-1, December 1971.